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THESIS

ANALYSIS OF MARINE CORPS TACTICAL LEVEL COMMAND AND CONTROL AND DECISION MAKING UTILIZING FBCB2-BFT

by

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13. ABSTRACT (maximum 200 words)

The speed and means at which information is acquired, developed and utilized has changed substantially over the last two decades, as the Marine Corps has made the transition from their traditional means of situational awareness (SA) and common operational picture (COP) development through radio updates and map boards, to the advanced information system enabled graphical user interface (GUI) by means of Force XXI Battle Command Brigade and Below-Blue Force Tracker (FBCB2-BFT). The commander's understanding of the situation formerly relied on the push-pull of information between himself, his subordinates, higher, and adjacent units. Now, the commander and his subordinates share a near-real time enhanced flow of information. The introduction of FBCB2-BFT greatly improves the ability to obtain SA and knowledge at all levels.

This study examines the impact of FBCB2-BFT on tactical level command and control (C2) and decision making. Via a survey, the researcher's elicited opinions from 114 veterans of Operations Enduring and Iraqi Freedom about the effects of FBCB2-BFT on operational decision making and its impact in real world situations.

The survey results indicate that the categories of operation referenced (OEF/OIF) and Military Occupational Specialty (MOS) domain (Aviation/Ground) are statistically significant factors in influencing how FBCB2-BFT is used.

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ANALYSIS OF MARINE CORPS TACTICAL LEVEL COMMAND AND CONTROL AND DECISION MAKING UTILIZING FBCB2-BFT

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LIST OF ACRONYMS AND ABBREVIATIONS

1stLt   First Lieutenant

ACE   Air Combat Element

AN/PRC   Army/Navy Portable Radio Communication

AO   Area of Operations

BFT   Blue Force Tracker

BLOS   Beyond Line of Sight

C2   Command and Control

C2PC   Command and Control Personal Computer

Capt   Captain

CE   Command Element

COC   Combat Operations Center

Col   Colonel

COP   Common Operational Picture

COTM   Communications on the Move

DACT   Data Automated Communications Terminal

D-DACT   Dismounted-Data Automated Communications Terminal

DLI   Defense Language Institute

DoD   Department of Defense

EPLRS   Enhanced Position Location Reporting System

EWS   Expeditionary Warfare School

FBCB2   Force XXI Battle Command Brigade and Below-Blue Force Tracker

GCE   Ground Combat Element

GIG	Global Information Grid
GPS	Global Positioning System
GUI	Graphical User Interface
HMMWV	High Mobility Multipurpose Wheeled Vehicle
HQ	Headquarters
HHQ	Higher Headquarters
HQMC	Headquarters Marine Corps
IED	Improvised Explosive Device
IOW	Intelligence Operations Workstation
IRB	Institutional Review Board
IT	Information Technology
LCE	Logistics Combat Element
LOS	Line of Sight
MAGTF	Marine Air-Ground Task Force
Maj	Major
MCCSC	Marine Corps Command and Staff College
MCDP	Marine Corps Doctrinal Publication
MCWP	Marine Corps Warfighting Publication
M-DACT	Mounted-Data Automated Communications Terminal
MEDEVAC	Medical Evacuation
MOS	Military Occupational Specialty
NLOS	Non-Line-of-Sight
NPS	Naval Postgraduate School
OEF	Operation Enduring Freedom

OIF   Operation Iraqi Freedom

PEO C3T   Program Executive Office Command Control
            Communication – Tactical

QRF   Quick Reaction Force

SA   Situational Awareness

SATCOM   Satellite Communications

SINCGARS   Single Channel Ground and Airborne Radio
            System

TOC   Tactical Operations Center

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I.   INTRODUCTION

A.   BACKGROUND

Historically, Marine Corps battalions/squadrons[1] developed their situational awareness (SA) and common operational picture (COP) through voice communications, map boards and handheld global positioning systems (GPS). Commanders communicated with subordinate units through line-of-sight (LOS) propagation radio transmissions and relays, and rarely did they reach more than one level down the chain of command. The commander's understanding of any situation relied on the push-pull of information between himself, his subordinates, higher, and adjacent units. Conversely, company level units relied heavily on the battalion commander and his staff for information outside their immediate area. Due to the inherent uncertainty of battle (fog of war) and the limited range of radio communications, mission type orders were issued that clearly articulated the commander's intent and allowed the subordinate leader to exercise his initiative within that intent. Once radio communications were lost, the leader charged with accomplishing the mission was forced to make decisions without conferring with higher headquarters and higher headquarters was left to assume that subordinates were executing the mission within their intent. Once

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[1] From this point forward, the word "battalion" will predominately be used in lieu of the term battalions/squadrons. At the Marine Corps tactical level, battalions and squadrons are synonymous, with exception that battalions represent the ground component and squadrons represent the aviation component. Variation does occur, but typically, these are units of 400-800 personnel and commanded by a Lieutenant Colonel.

communications were reestablished, any significant events
that had occurred were conveyed to higher headquarters. The
Marine Corps embraced this concept of command and control
(C2) and, according to Marine Corps Doctrinal Publication 6
(MCDP6) Command and Control,

> The Marine Corps' concept of command and control
> is based on accepting uncertainty as an
> undeniable fact and being able to operate
> effectively despite it. The Marine Corps' command
> and control system is thus built around mission
> command and control which allows us to create
> tempo, flexibility, and the ability to exploit
> opportunities but which also requires us to
> *decentralize and rely on low-level initiative.*

The development and fielding of FBCB2-BFT significantly
increased the level of SA for all users [U.S. and coalition
service members], regardless of echelon of command. For
example, Marine Corps battalion commanders can now not only
view the individual battlespace locations and enemy related
actions of their subordinate commanders at the tactical
level, but they can track movement down to the lowest levels
of their command, and Army and coalition counterpart blue
forces in near-real time. The capabilities of FBCB2-BFT
include map overlays, friendly force positioning, text
messaging, line of sight analysis, and medical evacuation
(MEDEVAC) requests. The transformational capabilities
provided by FBCB2-BFT include increased SA capability
through the detailed tracking of blue forces discussed
previously, and the over the horizon communications via L-
Band satellite link. These capabilities allow any FBCB2-BFT
user to graphically locate and communicate with other linked
blue force units over extensive distances. This connectivity

could have an impact on how the Marine Corps defines and operationalizes C2 in the modern operational environment.

B.   PURPOSE

The purpose of this research is to analyze the effects of FBCB2-BFT on C2 and decision making at the Marine Corps battalion level and below. FBCB2-BFT was first fielded at the battalion level during Operations Enduring and Iraqi Freedom (OEF and OIF) in 2002. Since that time, the system has become ubiquitous from the division to squad level. Junior leaders now enjoy an increased SA via FBCB2-BFT that was initially only available to senior officers. The SA advantage provided through FBCB2-BFT to junior leaders develops their ability to make optimally informed decisions, but their decision rights are still determined by those with proper authority. In order for them to possess the latitude to execute initiative, their decision rights must be advocated down the chain of command. The alternative is for senior officers within the chain of command to assume a more active management role using their own increased SA.

This research provides some insight into whether or not doctrinal C2 architectures have changed as a result of FBCB2-BFT introduction, and how FBCB2-BFT specifically impacted C2 and decision making at the tactical level.

C.   THE RESEARCH QUESTIONS

1.   Primary Research Question

The introduction of advanced information technology (IT) systems has had an impact on the tactical level community, but how much impact it has had is an important

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question to be asked and answered. If operational decision makers are going to precede or at least evolve with inevitable IT changes, this answer must be discovered. Therefore, the primary research question of this thesis is how has the introduction of advanced IT systems [FBCB2-BFT] influenced C2 and decision making in an operational environment at the tactical level (Marine Corps battalion level) and below?

2. Secondary Research Questions

Prior to answering the primary research question, the research must answer a few preliminary questions. Specifically:

- What is C2?

- What are the roles, functions, and responsibilities of the C2 architecture?

- How does network positioning affect C2?

- Does FBCB2-BFT allow for greater autonomy for decision making at the battalion level and below?

D. SCOPE

The scope of this thesis includes:

- A discussion of the background regarding Marine Corps C2 doctrine and tactical level decision making.

- An analysis of the current organizational architecture and decision rights hierarchy within the Marine Corps battalion model.

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- A description of theories and concepts that are directly related to the subject matter.

E.   METHODOLOGY

Marine Corps doctrinal publications provide the foundation for the Marine Corps' C2 structure, and establish the scope of its decision making practices. Unit after-action reports, service lessons learned, and previous research in this area were then used to introduce the traditional means by which tactical level units operated prior to the integration of IT systems, specifically FBCB2-BFT.

The research methodology focuses on evaluating the hypothesis that "FBCB2-BFT enables leaders to exercise greater autonomy in C2 and decision making at the battalion level and below." This was accomplished through a qualitative and quantitative analysis of a convenience sample of data—specifically, opinions of officers that served and operated in tactical level billets with and without FBCB2-BFT—based on paired (before and after) information.

Data collection was achieved using an Internet-based survey application. Surveys are continually used in both the commercial and government sectors to assess the impact of policy changes or quality of life. The Marine Officers provided an adequate sample, and results of which are likely to reflect opinions in the broader Marine Corps officer population in spite of the fact that the survey respondents were not a random sample of that population as will be explained in Chapter III.

F.   ORGANIZATION OF THE THESIS

Chapter II, Literature Review, provides a brief history and description of the important concepts, theories and technologies appropriate to the assimilation of information systems and decision making.

Chapter III explains the design and development of the survey instrument. It also discusses the IRB and survey fielding process.

Chapter IV describes the qualitative and quantitative analysis and findings of the data.

Chapter V provides a conclusion for the research study, as well as articulates areas that warrant further analysis through future research.

II. LITERATURE REVIEW

A.   THEORY AND DOCTRINE

1.   Command and Control

The concept of C2, although not formally defined as a singular term until the 20th century, is one that has been theorized about and practiced for centuries as interrelated operational concepts (Alberts, Huber, & Moffat, 2010). Prior to this era, the focus was predominately on *command,* but did in fact include *control* as evidenced in the writings of Antoine-Henri Jomini in *The Art of War* about Napoleon I and his efforts to control dispersed troops (Jomini, 2004). It is important to understand the foundation and maturity of both the components and the composite concept of C2 because of its direct relationship with responsibility and decision making. One of the most well-known military theorists who spent much of his time and writings on this subject was Carl von Clausewitz. His most notable treatise was *Vom Kriege*, which translates into English as *On War*. Clausewitz, a Prussian soldier during the late 18th and early 19th centuries, followed what was deemed a traditional view of the control aspect of C2 during that time in that it "was limited by what the commander could see, and the distance travelled by visual and audio signals" (Clausewitz, 1989). This belief was generally suitable for this era because battlefields were relatively small and well-defined, and battles were usually short in duration. Troops fought as a concentrated mass, and weapons were short-ranged by today's standard. Even then, Clausewitz realized that the existence

of a tactical level was simply a reflection of the practical issues that face commanders, and the control measures that they adopt to overcome them. These "issues" included the "geography they operate in, the scale of forces involved, and the technology that defines the capabilities of these forces in terms of mobility and firepower, the logistics required to support them, and the communications that control them" (Clausewitz, 1989).

Clausewitzian theories are still relevant and used today, albeit in a slightly different fashion. In fact, the Marine Corps doctrinal publication on C2 begins with a quotation from Clausewitz when introducing the nature of C2. It states that "The commander must work in a medium which his eyes cannot see; which his best deductive powers cannot always fathom; and with which, because of constant changes, he can rarely become familiar" (U.S. Marine Corps, 1996). This quotation demonstrates how C2 doctrine has stood the test of time, but how it also requires updates to stay relevant with the changes brought forth by would-be adversaries. The discussion of C2 evolution must occur, because as the Marine Corps states "no single activity in war is more important than command and control" (U.S. Marine Corps, 1996). For the Marine Corps to truly convey its message and guidance on how today's commanders must address this concept, they must first explain its definition and why it is so important. The Marine Corps sees C2 today as an activity that "encompasses all military functions and operations, giving them meaning and harmonizing them into a meaningful whole. None of the military functions and operations would be purposeful without command and control." (U.S. Marine Corps, 1996) The harmonizing of all

functions and operations into a meaningful whole revolves around the military commander and the inherent C2 and decision-making responsibility accompanying their position; however, the direction and influence may vary (see Figure 1).
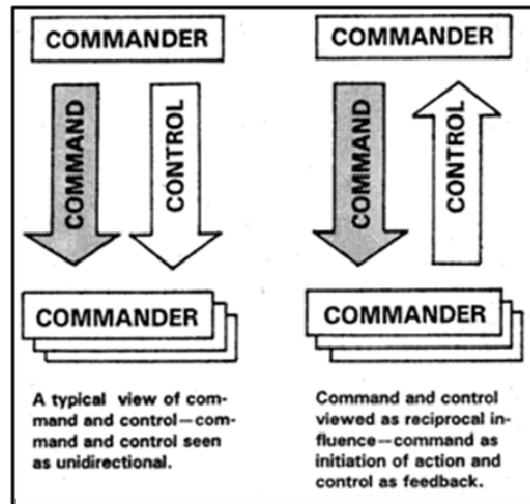
Figure 1.   Two views of the relationship between command and control (From: [U.S. Marine Corps, 1996])

It is important to note that C2 may function in more than one way, especially when considering that the role, capability and organization of the military continue to transform. The lack of a single finite answer affords the commander latitude, and it is this latitude that will be captured and analyzed to determine impact. It should already be apparent that C2 is intrinsically complex, which leads into the next section.

a.   Complexity in C2

The Marine Corps acknowledges that war, military organizations, and military evolutions are complex (U.S. Marine Corps, 1996). Because the Marine Corps is setup as a hierarchical organization (i.e., squad-platoon-company-

etc.), and because each level of the organization could be complex in and of itself, conceivably you could have levels of complexity within an already complex organization operating in a complex and unpredictable environment. It is this hierarchical structure and the interaction between levels that is pertinent to this research, because if independently they are complex, then their amalgamation will greatly affect the ability to conduct C2. Each part affects other parts in ways that simply cannot be anticipated, thus resulting in C2 complexity (U.S. Marine Corps, 1996).

Two questions should be asked at this point: (1) How do commanders cope with this complexity, and (2) what options does doctrine provide the commander? The means by which commanders cope with complexity within their units is mostly something that is intangible and inherent within them, but they also have a delegation option that may mitigate their own C2 complexity. They must ensure that what they delegate falls under the confines of what is authorized by regulations and doctrine, while concurrently determining the potential impact on operations of disjointed C2, if what they delegate to their subordinates exceeds an acceptable level of information sharing. This acceptable level is really indeterminate, and at the root of the question of how advanced IT systems [FBCB2-BFT] enable decision making.

Alternatively, the regulations and support provided by the Marine Corps are something very tangible. The Marine Corps has developed procedures and systems in an attempt to manage the C2 complexities in their organization and on the battlefield, and all of which appear to be directly correlated to information management (see Figure

2).   This figure provides one example of how the Marine Corps views the relationship between C2 and information flow, and if commanders follow the holistic view presented, they are likely to mitigate inherent complexities through improved personnel and system utilization. These aspects are unmistakably present and at the crux of Figure [2], and thus, should be employed to maximize C2 and decision-making capability. The presence of a C2 support structure is also an important aspect and will be further defined in the "C2 Support" subsection of this chapter.
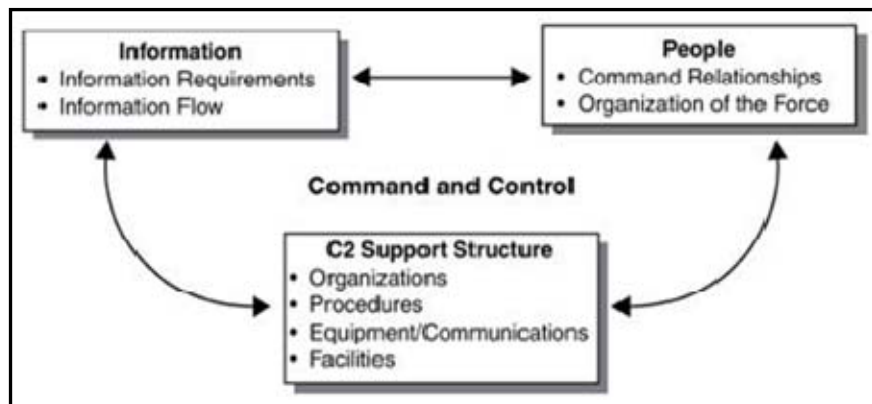
Figure 2.   Elements of command and control (From: [U.S. Marine Corps, 2002])

b.   Information→Knowledge→Decision

The idea of information management is not new to today's Marine Corps as it was doctrinally present in 1994, but its progression has changed substantially in recent years appearing across the spectrum of doctrine, and in greater detail (U.S. Marine Corps, 1994). In 1994 the definition of C2 information management was "a process aimed at attaining timely critical information to support decision making and dissemination of decisive information to the right place, at the right time, and in a form that

influences appropriate action" (U.S. Marine Corps, 1994). It goes on to state that "information management is based on principles that govern its quality and flow throughout the cycle of collecting, transporting, processing, disseminating, and protecting information." More recently, however, the Marine Corps Warfighting Publication (MCWP) on Information Management, while presenting a similar approach to explaining information management, goes more in depth as it separates information into four classes within a hierarchical architecture (see Figure 3). It is the synthesizing of information (i.e., *processed data class*) into the eventual *understanding class* that is the focus of research, because this represents the baseline from which commanders harness the SA needed for optimally informed decisions. The MCWP states that the ultimate goal is to "facilitate the development of quality information throughout the information hierarchy, thus increasing its value and relevance and ensuring the development of understanding by the commander" (U.S. Marine Corps, 2002). Figure [3] shows how data flow eventually leads to decision making, but it is important to note that a transformation to knowledge and coupling with judgment occurs during the process. "Situational awareness can be obtained in some level with raw data, but it tends to strengthen as information moves through the information hierarchy." [knowledge] (U.S. Marine Corps, 2002)
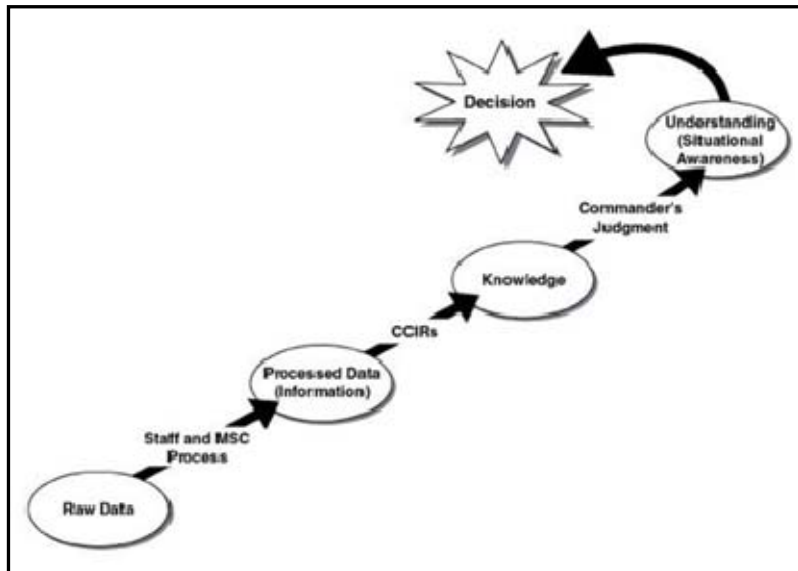
Figure 3.   Information flow (From: [U.S. Marine Corps, 2002])

A commonality of information, knowledge and decision making exists throughout C2, and the following quotation supports this statement:

> Confronted with a task, and having less information available than is needed to perform that task, an organization may react in either of two ways. One is to increase its information processing capacity, the other to design the organization, and indeed the task itself, in such a way as to enable it to operate on the basis of less information. These approaches are exhaustive; no others are conceivable. A failure to adopt one or the other will automatically result in a drop in the level of performance. (Creveld, 1985)

The important part of the information flow process is how SA is obtained by the commander for decision making. In the past, this was accomplished through a series of radio transmissions back and forth between the commander or his staff and subordinate units. It was through these radio

updates that the commander and his staff could build SA regarding the disposition of the battlefield. To best capture these updates, when time and environment allowed, a commander would have maps and other materials with a collective graphical depiction of the operational environment (see Figure 4). Information updates were both pushed from subordinates and pulled from the commander and/or his staff as necessary or directed. If control was necessary, it either came in the form of the commander guiding his subordinates, or the subordinate commander would execute autonomously. Again, time and environment were directly relevant and influential on how C2 was conducted (i.e., hostile vs. permissive environment).
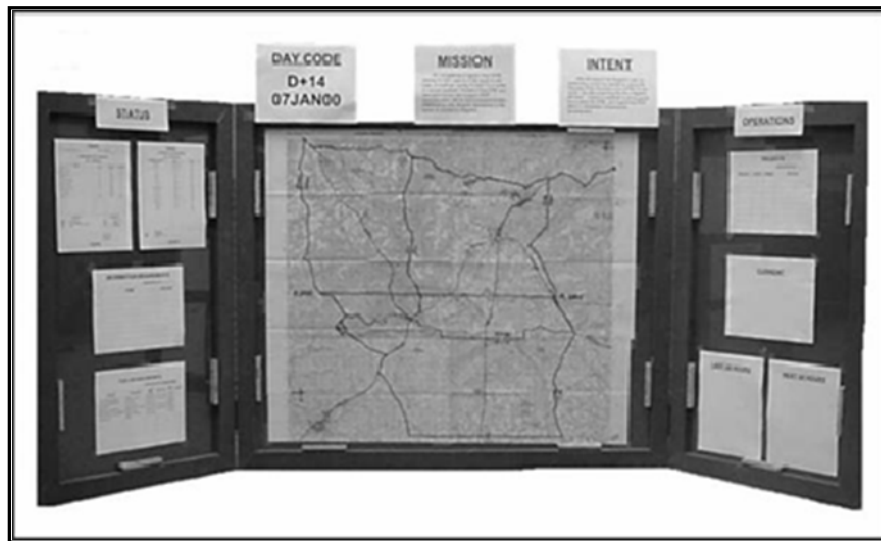
Figure 4.   Example paper map board (From: [Caceres & Swearingin, 2005])

The intent, as shown in Figure [3] and described in [20], is for the commander to be the decision maker at the end of the information flow process, which assumes an optimally informed decision. However, real-world tactical operations may preclude the commander from always being the

decision maker and/or receiving the information necessary to make the best decision. Therefore, decision delegation must occur, and the beneficiary must be able to receive the same information as the commander. Bridging the gaps between the inaccessible and accessible, and uninformed and informed through information systems integration is something very real and worth exploring. This uninformed state may be the result of receiving erroneous, incomplete or inaccurate information, all of which are addressed by FBCB2-BFT.

The introduction of advanced IT systems, such as FBCB2-BFT, allow commanders to tailor the vast amounts of information to suit their specific requirements through filtering techniques, and also enables the ability to share this tailored information as desired. Therefore, FBCB2-BFT provides the ability to reduce hierarchical information flow complexity that inherently exists within the C2 information flow process. As a byproduct of the COP provided by FBCB2-BFT, organizations now have the ability for decision making to occur at the lowest levels.

2. Roles, Functions, and Responsibilities

a. Introduction

Thus far, the information provided has concentrated on the C2 aspect of tactical level operations, but in order to truly understand decision making and its development and role in the Marine Corps, we must introduce those personnel responsible for its execution. First and foremost, it should be noted that "roles are the broad and enduring purposes for which the Marine Corps was established by Congress by law. Functions are specific responsibilities

assigned by the President and Secretary of Defense to enable the services to fulfill their legally established roles. Various laws, directives, and manuals establish the roles and functions of the Marine Corps and describe the general composition and responsibilities of the Marine Corps." (U.S. Marine Corps, 2001) Some of the key sources that bind and reinforce these statements are Title 10, United States Code, *Armed Forces*; Goldwater-Nichols Department of Defense Reorganization Act of 1986; Department of Defense Directive 5100.1, and Marine Corps Doctrinal Publication (MCDP) 1-0.

b.   *Commander and Command*

Command, control, information management and decision making are all important enabling concepts for leaders within the Marine Corps to carry out their roles and responsibilities, but they are inadequate without the human controller. Specifically for the Marine Corps, the human controller and focal point of tactical operations is the *commander*. The person assigned the billet of commander is granted lawful *command* over a military unit of varying scope and function, as established in the preceding section. The term command, as defined by Joint Publication 1-02 is "the authority that a commander in the armed forces lawfully exercises over subordinates by virtue of rank or assignment. Command includes the authority and responsibility for effectively using available resources and for planning the employment of, organizing, directing, coordinating, and controlling military forces for the accomplishment of assigned missions. It also includes responsibility for health, welfare, morale, and discipline of assigned personnel" (U.S. Joint Staff, 2001). The C2 process enables

the commander to exercise command across the extent of his force. It provides the means for the commander to develop an understanding of the situation, decide what actions are necessary, transmit orders to subordinate commanders, monitor the execution of those instructions, and assess the results. Command and control is the key to achieving unity of effort and realizing the full potential of the unit. Directly supporting the commander is a judiciously designed C2 infrastructure for obtaining, analyzing, and submitting information to them to assist in decision making, within which subordinate commanders are an essential part. However, the proper exercise of C2 remains the sole responsibility of the commander, indicating a strong level of autonomy at that level (U.S. Marine Corps, 2003).

c.   C2 Support

Collectively, the commander's staff officers are accountable for the commander's entire domain of responsibilities, unless otherwise specified by the commander. A staff officer's authority is limited to advising, planning, and coordinating actions within their field of expertise or interest. The commander might also grant a staff officer added authority to act within their expertise or interest. Ultimately, staff officers are responsible for acquiring information and analyzing its implications to provide timely and accurate recommendations to the commander. Effective C2 support of expeditionary operations demands an unyielding effort on the part of the commander's staff, and "the ability to exercise effective C2 is critical to the success of what the Marine Corps calls its Marine Air-Ground Task Force." (U.S. Marine Corps, 2003)

d. Marine Air-Ground Task Force (MAGTF)

The Marine Corps' overarching scalable model from which its tactical level commander functions is called a MAGTF (pronounced Mag Taff). A MAGTF is made up of four core elements, which are: (1) Command Element (CE), (2) Ground Combat Element (GCE), (3) Aviation Combat Element (ACE), and (4) Logistics Combat Element (LCE, (formerly CSSE)) (see Figure 5). With the MAGTF model, the Marine Corps is able to task organize for operations consistent with its statutory tasking to provide combined arms forces to the Joint Commander. The MAGTF is a balanced, air-ground combined arms team under the control of a single commander, and structured to accomplish a specific mission (U.S. Marine Corps, 2001).

Figure 5. MAGTF organization (From: [U.S. Marine Corps, 2001])

e. Expeditionary Maneuver from the Sea

Expeditionary Maneuver from the Sea, the Marine Corps' current operational concept, forms the basis for developing the MAGTF C2 process. Expeditionary Maneuver from the Sea demands a C2 process that provides maximum

flexibility in the execution of the mission in accordance with the commander's intent. To enable this kind of focused flexibility the Marine Corps requires a robust information infrastructure. Any future global information grid (GIG) must be designed to allow members of the commander's staff to locate and retrieve information to form decisions. The risk of information deluge or faulty retrieval is significant and therefore must be minimized at all cost. Similarly, the Marine Corps believes that it must continue to train its leaders to recognize situations based on the information provided, and to act with confidence and autonomy when that information is inconsistent or incomplete (U.S. Marine Corps, 2008).

f.   People and Information

The undeniable catalyst of the C2 system is people. People gather information, make decisions, take action, communicate, and cooperate with one another to accomplish a common mission. Effective C2 starts with qualified people and a common philosophy that is developed and presented by the commander. Information refers to representations of reality used to inform decisions and actions. Ultimately, C2 is about information: getting it, judging its value, processing it into useful form, acting on it, and sharing it with others. Without a C2 support structure to develop information, commanders must have the confidence and willingness to either pursue certainty or cope with uncertainty. Either way, they are the ones ultimately held responsible for the results (U.S. Marine Corps, 2003).

3. Network Science

a. *Power and Influence*

Merriam-Webster defines "power" as "legal or official authority," which as discussed previously is an attribute innate in the role of commander. However, it also defines power as "the ability to act or produce an effect and possession of control, authority, or influence over others." It is this second definition, and in particular the word *influence*, that sets commanders apart in network science. Power [authority] may be innate, but influence is produced. The notions of power and influence are nearly synonymous with one another, but when examined from a network science perspective they are distinct. Knowledge is commonly referred to as power, but it is its synthesis into information that is truly *influential* to C2 and decision making. The introduction and development of the IT systems network has revolutionized the ability to access knowledge, but only those with positions in the network can capitalize on information and influence.

When the study of networks was conducted by Leonhard Euler in the 1780s the focus was more on abstract mathematics and less on the sociological power derivative, but as the more modern networks emerged the focus of research has changed (Barabasi, 2002). Modern researchers, such as Jeffrey Pfeffer and Linton Freeman, have taken a new approach that studies the impact of networks on individuals and individuals on networks. Pfeffer and Freeman have examined networks for their impact on human communications [power and influence]. They believe that by understanding how networks function and grow, one can develop strategies

to take advantage of that growth. The integral element of the end result is a concept called *network centrality* (Barabasi, 2002).

b. *Network Centrality*

Real-world networks are not randomly distributed, consequently resulting in positions of greater power and influence for those with the most and shortest connections (Barabasi, 2002; Pfeffer, 1992). "To develop influence, we need to be plugged into the structure of communication and interaction, and that means seeking out interactions, even social interactions, strategically" (Pfeffer, 1992). The takeaway from this quote by Pfeffer is that the ability to influence is available to those connected. Without technology, connecting was accomplished by physical proximity or by seeking out interaction, but as advanced IT systems such as FBCB2-BFT have become integrated into tactical networks, connections can now occur with masses of people simultaneously over long distances. Consequently, commanders are afforded the ability to exert power and influence on a larger scale.

One concept that Freeman created to describe this notion of centrality is called *betweenness*. In essence, betweenness is the extent to which a person falls between other individuals on the communications path that links them (Freeman, 1977). The gist of betweenness and centrality within a network is best shown graphically using examples of today's network topologies (see Figure 6). The left side of Figure [6] shows a star topology where a short path exists between each outer node and the hub (center node), but at the risk of the hub being a single point of failure. In this

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instance, the hub is really the only node with any significant level of betweenness. With the fully connected mesh topology on the right side of Figure [6], where all nodes are connected equally, the likelihood of failure is considerably reduced (Freeman, 1977). In this instance, all nodes share the same level of betweenness.
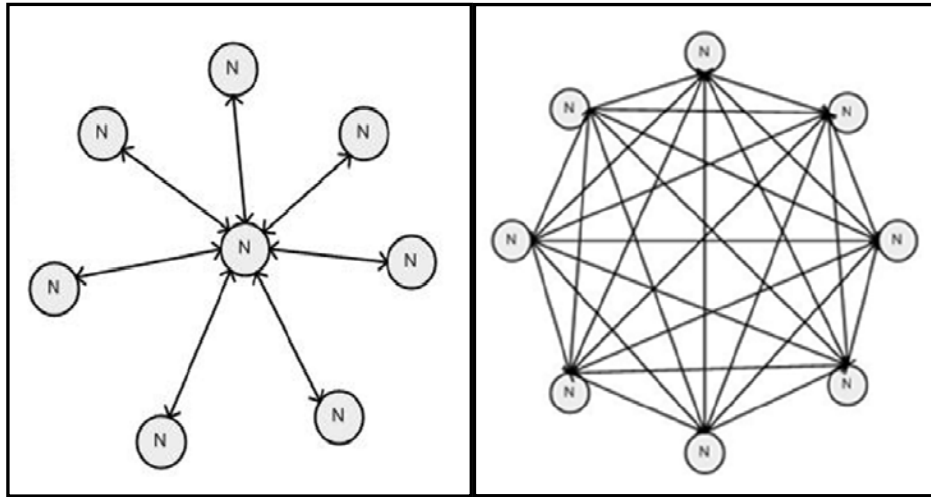
Figure 6.   Network topologies (From: [Saldana, Shannon, & Chow, 2007])

The FBCB2-BFT network most closely resembles the latter topology in Figure [6] in that a shared level of betweenness exists between nodes, and thus the question of decentralized C2 and decision making could be raised. However, with the introduction of Figure [7], which displays a powerful illustrative example of the hierarchical relationship that exists in the Marine Corps between commanders' and C2 systems, the introduced complexity counters the decentralization argument (see Figure 7).
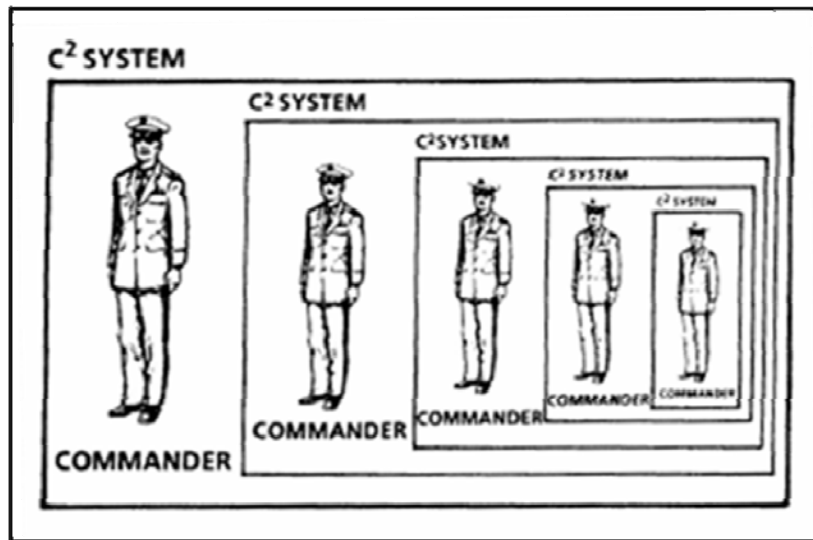
Figure 7.   Commander's   relationship   to   C2   systems
      (From: [Coakley, 1992])

Inevitably, the FBCB2-BFT network supports the
opportunity for decentralized C2 and decision making.
However, because of inherent organizational complexity and
commander's discretion, decentralization may not occur.   The
ability to exert power and influence through the FBCB2-BFT
network exists, and although Marine Corps doctrine advocates
one approach [decentralization and initiative]; commanders
are ultimately the employment decision makers.

B.   THEORY AND DOCTRINE MEET TECHNOLOGY

1.   Chronology of IT Systems

As previously mentioned, the C2 of dispersed forces is
dependent   on   information   flow   between   commanders   and
commanded, as well as between units in the field.   The

following sections of Chapter II will discuss the technologies from which FBCB2-BFT evolved, and its current capabilities.

a.   *Short-range, Two-way Radiotelephone*

For purposes of this research, modern Marine Corps tactical communications networks began with the Army/Navy Portable Radio Communication (AN/PRC)-77 transceiver that was the workhorse during the Vietnam conflict (see Figure 8). This system entered service in 1968, and was the COP and C2 enabler for its time through its short-ranged, two-way radiotelephone voice communication (Caceres & Swearingin, 2005).

Figure 8.   AN/PRC-77 (From: [AN/PRC-77 Tactical Radio Set, 2007])

b.   *SINCGARS and EPLRS*

The next set of technological developments came about in the early 1980s, but did not see substantial

distribution until the late 1980s-early 1990s. The Single Channel Ground and Airborne Radio System (SINCGARS) radio and Enhanced Position Location Reporting System (EPLRS) networked systems (see Figure 9) added substantial capability to Marine Corps tactical communication and information. The combination of these systems enable secure and jam resistant voice and data communications in near-real time, and were the primary components that formed the backbone of the tactical internet for the regimental level and below (Caceres & Swearingin, 2005). This combination also introduced the concept of communications on the move (COTM).
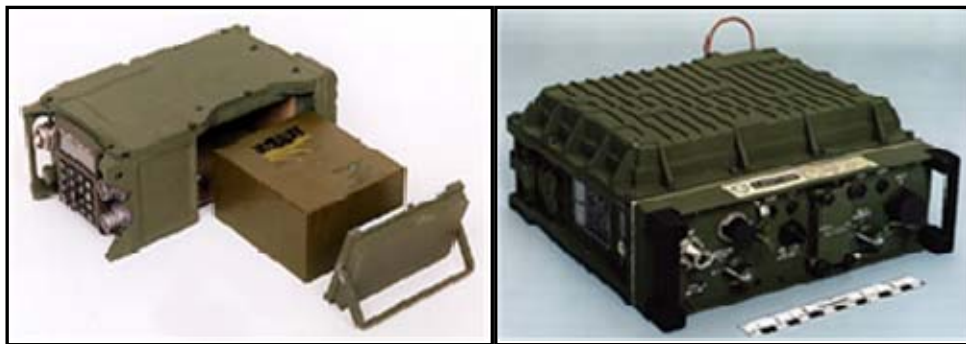
Figure 9.   AN/PRC-77 and EPLRS RT-1720C(C/G) (From: [Caceres & Swearingin, 2005])

c.   C2PC w/ DACT

In the mid-1990s, the next generation of C2 technologies was the ubiquitous Windows-based client application known as Command and Control Personal Computer (C2PC), and the C2PC hosting platform called the Data Automated Communications Terminal (DACT).

C2PC is not a system but instead an application that can be deployed on a variety of programs. C2PC started

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out as a COP-viewer with its tactical map display, but evolved into a full-fledged COP-client through a GUI that allowed for full track add, modify and delete capabilities, an extensive overlays production capability, numerous tactical decision aids, and the ability to send and receive tactical messages.

The primary carrier of C2PC for the Marine Corps was the DACT-PC, which also has a mounted (M-DACT) and dismounted (D-DACT) version (see Figure 10). The family of DACTs is GPS-enabled and provides the ability to self locate and self report (Caceres & Swearingin, 2005).
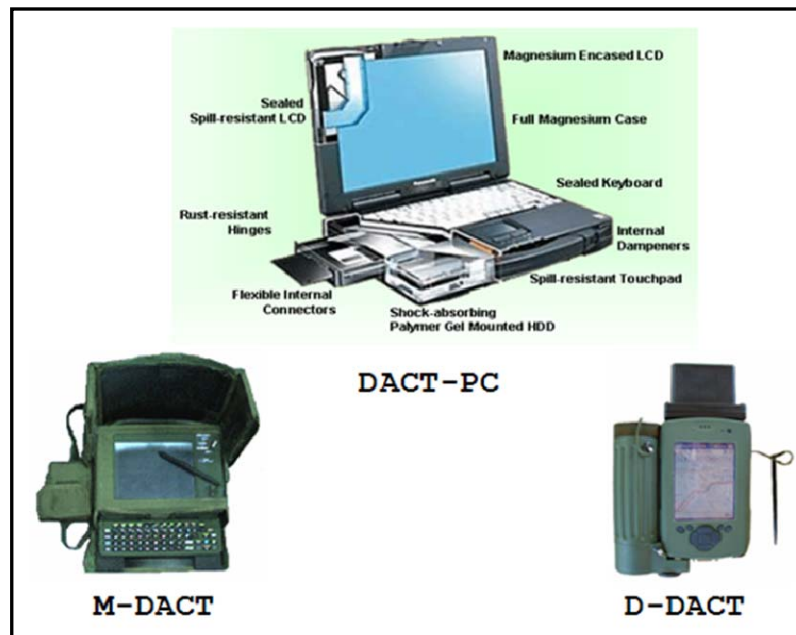
Figure 10.   C2PC supported variants (After: [(Caceres & Swearingin, 2005) and (Wagner, 2006)])

The topology of the C2PC network was unique and brought about tremendous value through its ability to handle different versions of clients and gateways, act as a server and prevent COP disruptions, and have a multi-tier architecture that could be extended (see Figure 11).
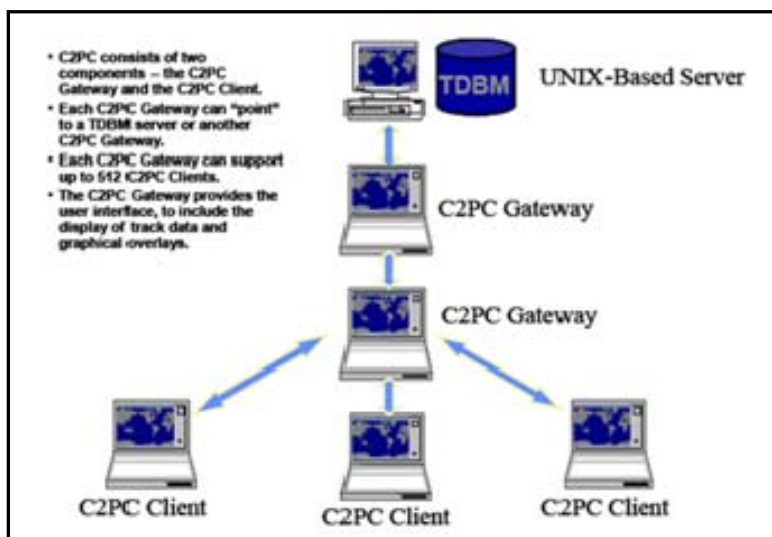
Figure 11.   Basic C2PC network topology (From: [Caceres & Swearingin, 2005])

As with its predecessor, C2PC maintains only a LOS capability since the Marine Corps was still dependent upon the EPLRS data network as the backbone. This leads to present day systems.

d.   FBCB2-BFT and SATCOM

Force XXI Battle Command Brigade and Below-Blue Force Tracker is the L-band satellite communications (SATCOM)-based variant of the United States Army's FBCB2 ground radio-based communications platform, which was originally designed and fielded for three missions: (1) To allow U.S. Army units below the brigade level to "see" Marine positions on their FBCB2 network, (2) To complement the COP provided by the intelligence operations workstation (IOW) and M-DACT, and (3) To allow non-line-of-sight (NLOS) two-way messaging (Stengrim, 2005). The SATCOM capability was provided by merging with a commercial satellite network which makes the system sensitive but still unclassified

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(Austin, 2006). The initially undocumented but important benefits the system provides are the unprecedented SA and C2 to ground forces engaging in combat, which result in the speeding up of war [increased operational tempo] and saving of lives (Guenther, 2004). The components of the FBCB2-BFT consist of a computer, used to display location information; a satellite terminal and antenna, used to transmit location and other military data, and a GPS receiver to determine its own position (see Figure 12).

Figure 12.   FBCB2-BFT components (From: [Conatser & Grizio, 2005])

The FBCB2 concept was initiated by the Army's Program Executive Office Command Control Communications – Tactical (PEO C3T) and awarded to TRW Inc. (part of Northrop Grumman since 2002) in 1995. It was first put into use in Yugoslavia in 1998, but did not see large scale employment until Operations Enduring and Iraqi Freedom in late 2002-early 2003 (Potts, Szcepanski, & Abejon, 2003). The Beyond Line of Sight (BLOS) capability was a principle reason for creating the BFT variant, and this capability was integral

to operations in the mountainous terrain of Afghanistan and with the speed of the initial invasion into Iraq.

The FBCB2-BFT gathers and graphically depicts information through a terrain-mapped GUI, allows individuals to exchange voice, video, or other data securely, and most importantly, provides a shared SA display. It is equipped in many types of vehicle platforms such as tanks, High Mobility Multipurpose Wheeled Vehicle (HMMWV), and helicopters (see Figure 13).
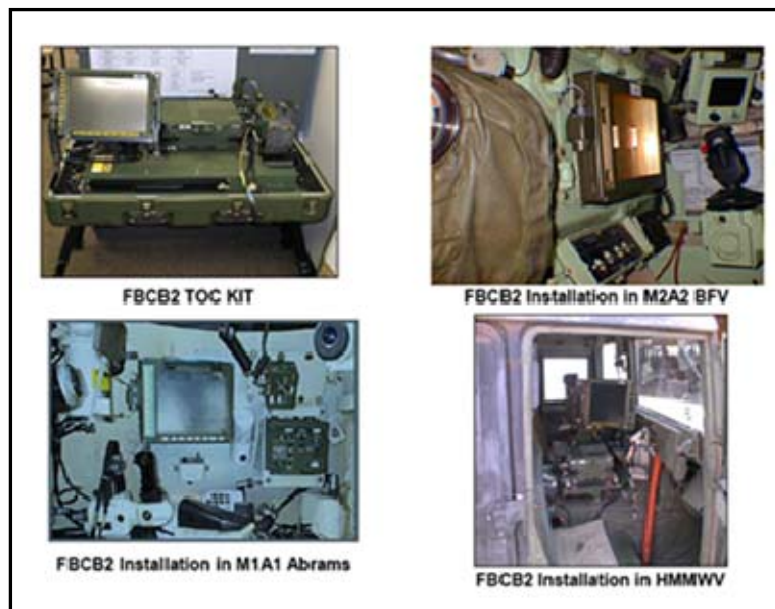
Figure 13.   FBCB2-BFT   installation   variants   (From: [Conatser & Grizio, 2005])

In addition to displaying the location of all friendly vehicles equipped with the system on the computer's display, the FBCB2-BFT can also be used as a mechanism for reporting the locations of enemy forces and other battlefield conditions (e.g., the location of mine fields, battlefield obstacles, damaged bridges). As these updates are occurring, the system continually transmits this

information over the FBCB2 and SATCOM networks to central locations called tactical operations centers (TOC). It is the integration of the TOC where the loop is closed on the FBCB2-SATCOM architecture. (see Figure 14).
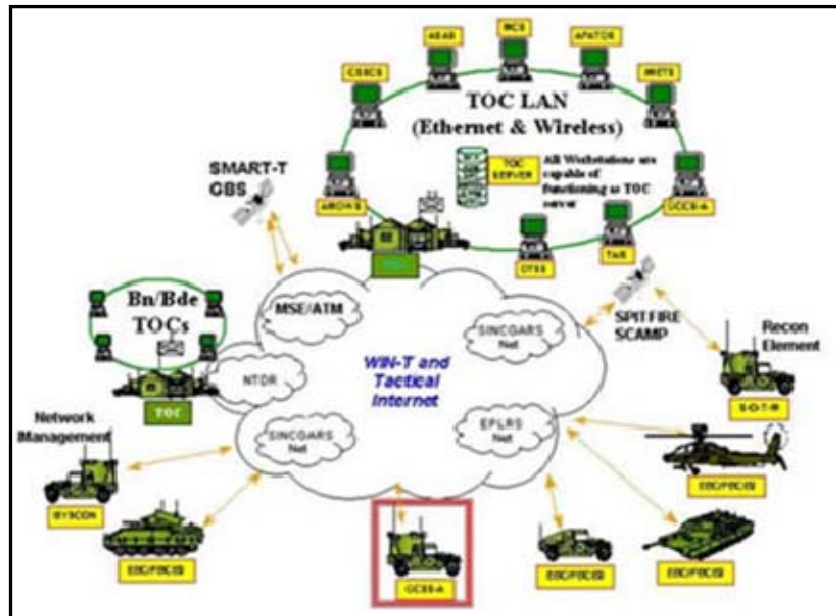
Figure 14.   FBCB2-BFT   architecture   (From: [Austin, 2006])

The FBCB2 and FBCB2-BFT integration of systems are widely considered a huge success. They have won numerous prestigious awards, and are a fratricide preventer for vehicles equipped with the system (Shachtman & Axe, 2006). Units equipped with FBCB2-BFT enjoy tremendous advantages over units without it, as emphasized by the quotation "Unit situation awareness has improved exponentially to levels achievable just 10 years earlier. Knowledge of situational awareness facilitates better situational understanding and decision making. FBCB2 enables commanders and leaders to command and control units more efficiently and effectively

and adapt more quickly than the enemy" (Robb, 2006). The following excerpt from Shane Robb's *FBCB2: past, present, and future* provides a great example of how this system compares to its non-technological supported predecessors:

> What does blue force tracking look like from the standpoint of the soldiers who use it? With BFT, there are no more map sheets spread out on a HMMWV hood, with soldiers battling sandstorms to paste sticky notes marking critical information. Computer terminals provide easy to interpret, moving blue icons on digitized maps and the latest available accurate satellite imagery for navigation, with regular information updates marking a huge contrast to missions based on static paper map information, which is often inaccurate and grows more stale with each minute and hour it takes forces to approach their target. (Robb, 2006)

FBCB2-BFT has unquestionably delivered numerous advantageous capabilities for Marine Corps tactical level units, and there appears to be no shortage of analogous systems on the acquisitions horizon (U.S. Army, 2010). However, the vast majority of FBCB2-BFT literature appears to exclusively focus on the increased connectedness it provides, and does not accompany it with an evaluation of the impacts on the real power behind the network – the people.

Knowing that future IT systems will provide similar capabilities as the FBCB2-BFT, it is essential that it be scrutinized in its entirety to ensure proper organizational [Marine Corps] integration and development.

C. CHAPTER SUMMARY

The literature offers insight into the synergistic relationship between information and decision making. It suggests that distance is becoming less relevant for the execution of C2, and information is quickly reaching a point of saturation as a result of information systems integration. The end result appears to be greater flexibility for the handling and delegation of C2 and decision rights, and better distribution of information. The certainty and impact of these premises are still undetermined since FBCB2-BFT inception was relatively recent, which leads to the origin of this thesis.

The literature suggests that the Marine Corps, and by logical extension the Department of Defense (DoD), has yet to understand how the integration of new information technologies into existing C2 structures will impact the ability of its commanders to effectively use their authority (power and influence) to accomplish mission objectives. Underlying issues such as those resistant to change and hierarchical constraints are likely present. Therefore, in addition to the already existing challenges that accompany the role, function and responsibility of command, commanders now face the difficult task of new system integration into their organizations.

The follow-on chapters will show the analytical trends resultant from the union of advanced IT systems and the tactical level Marine Corps.

III. METHOD

A Web-based survey was distributed in April of 2010 to gain insight into the use of the BFT[2] system from Marine officers with operational experience. The survey consisted of 50 questions and was partitioned into four major parts: demographics and operational experience, C2 experiences in a predeployment training environment, C2 experiences in a combat environment, and general opinion questions.

A. SURVEY DESCRIPTION

The survey began with a section focused on demographics and operational experience. Officers were first asked if they had served in a combat zone and then to identify how many separate OEF and OIF tours. Officers without combat experience were automatically advanced to the general opinion questions. Officers identified the operation (OEF or OIF) and year they returned from the subject deployment. They were asked to identify the highest rank attained, billet held and organizational level for this deployment. Billets were generalized into commander, executive officer, staff sections, and aviator. Officers could also type in their billet if it was not listed. Officers selected unit levels ranging from platoon to Marine Expeditionary Force. Next, the officers were provided an explanation of the BFT and identified whether they had used the system and how they

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[2] From this point forward, the acronym "BFT" will be used in lieu of "FBCB2-BFT." This approach was taken due to organizational inconsistency (Most Marines know and refer to the system as "BFT") and on the recommendation of the survey focus group.

learned to use it. Respondents who had not used the system were automatically advanced to the general opinion questions.

The second section focused on C2 during the officers' predeployment training. In order to refine the C2 environment, several questions referred specifically to operations conducted "outside the wire." For the purposes of this survey, the term "outside the wire" was loosely defined as operations conducted off an established forward operating base. Examples of outside the wire operations include patrols; convoys; route clearance; engineering; close air support, etc. Temporary combat outposts and patrol bases could be considered outside the wire. Types of communications systems were identified for each of the C2 scenario. Next, officers rated their immediate commander's and their personal exercise of mission command.

The third section focused on the respondents' combat experience. Questions in this section were identical to the predeployment section with the phrase "combat deployment" replacing "predeployment training."

The fourth and final section consisted of five opinion questions. Officers were asked two 5-point Likert scale questions, two open ended question and an opportunity for additional comments. All questions in this section provided an opportunity for further explanation or comments. The section ended with some additional demographic questions. A copy of the survey instrument is contained in the Appendix.

B.   SAMPLE DESCRIPTION

Survey respondents consisted of Marine Corps officer students at Naval Postgraduate School (NPS), Defense Language Institute (DLI), Marine Corps Command and Staff College (MCCSC) and Expeditionary Warfare School (EWS). In addition, the survey was also inadvertently completed by officers throughout the Marine Corps as a result of forwarding by some of the original recipients. Due to the anonymous nature of the Web-based survey, no breakdown of responses by institution is available.

The student populations at NPS, DLI, MCCSC and EWS were selected to receive the survey for two reasons. First, they provided a broad and diverse range of military occupational specialties and ranks typically resident at the tactical level. NPS alone has roughly 200 company and field grade officers from all elements of the MAGTF. Second, these institutions all fall under the cognizance of Marine Corps Training and Education Command; therefore, solicitation approval was only required from one command. This approach was taken in coordination with, and approval of, Headquarters Marine Corps (HQMC), Manpower and Reserve Affairs (MPP-50), which is the approval authority for surveys conducted within the Marine Corps.

As a convenience sample, the data provided in the survey and subsequent analysis cannot be treated as statistically generalizable to the entire Marine officer population. Nonetheless, the survey results are likely to reflect general opinions in the broader Marine Corps officer population indicating that the research question is one that can be answered by this convenience sample.

C. FIELDING PROCEDURES

Survey creation occurred over several months and went through multiple iterations. After gaining Institutional Review Board (IRB) approval (see Appendix for a copy of the approval letter), the survey was distributed to a ten-person focus group at NPS. The group consisted of graduate students in the Information Systems Technology and Manpower Management curriculums and all had operational experience with the BFT. The purpose of the focus group was to elicit feedback on the survey instrument. Group members were asked to comment on the clarity, flow, conciseness, and wording. Feedback from this group was incorporated into the final version. This type of "pretesting" is good survey practice.

Distributing the survey via the Internet as a Web-based survey rather than personal interviews was preferred for several reasons. First, electronic distribution allowed for greater access to a distributed target population, enabling EWS and MCCSC students to participate. Personal interviews for these populations would have been infeasible due to time constraints and schedule conflicts. Second, electronic distribution allowed for automation, which made it easier to survey a larger group, and it saved both time and money. Third, the support provided by NPS and its subscription to SurveyMonkey provided a cost effective and efficient medium.

The survey link was distributed to the target audience via an e-mail solicitation (see the Appendix) on 3 May 2010. Time spent completing the survey averaged approximately 10 minutes. The survey was taken offline on 10 June 2010. None of the questions were mandatory, and therefore could be skipped. Out of 147 responses, 114 were deemed useful and

included in the study. The 33 discarded surveys were deemed unfit mostly due to incomplete or inaccurate (hoax) responses.

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IV. RESULTS

This chapter is divided into three sections: (a) demographics, (b) comparison of C2 scenarios between training and combat, and (c) summary statistics and vignettes for select survey questions. Descriptive statistics are used in all categories and inferential statistics are used in Chapter IV.C.[3]

A. DEMOGRAPHICS

The respondents ranged in rank from First Lieutenant (1stLt) through Colonel (Col) with the most common rank being Captain (Capt). All respondents are combat veterans of OEF, OIF or both. Organizational levels and primary areas of billet responsibility held during the combat tour addressed in the survey spanned all four elements of the MAGTF and included transition teams and higher-level joint staffs. Organizational levels ranged from platoon to Corps with battalion/squadron level being the most common. Command billets represented 34% of the responses with aviators and staff officers comprising the rest. Figures [15] and [16] illustrate the organizational level and billet breakout, respectively.

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[3] As discussed in Chapter III, the respondents to this survey constitute a convenience sample from the Marine Corps officer corps. Thus, some caution is warranted in the interpretation of the inferential statistics. To the extent that the sample is representative of the entire Corps, these results may be generalizable. However, because of the convenience sample, these results also may only reflect the opinions of those surveyed.
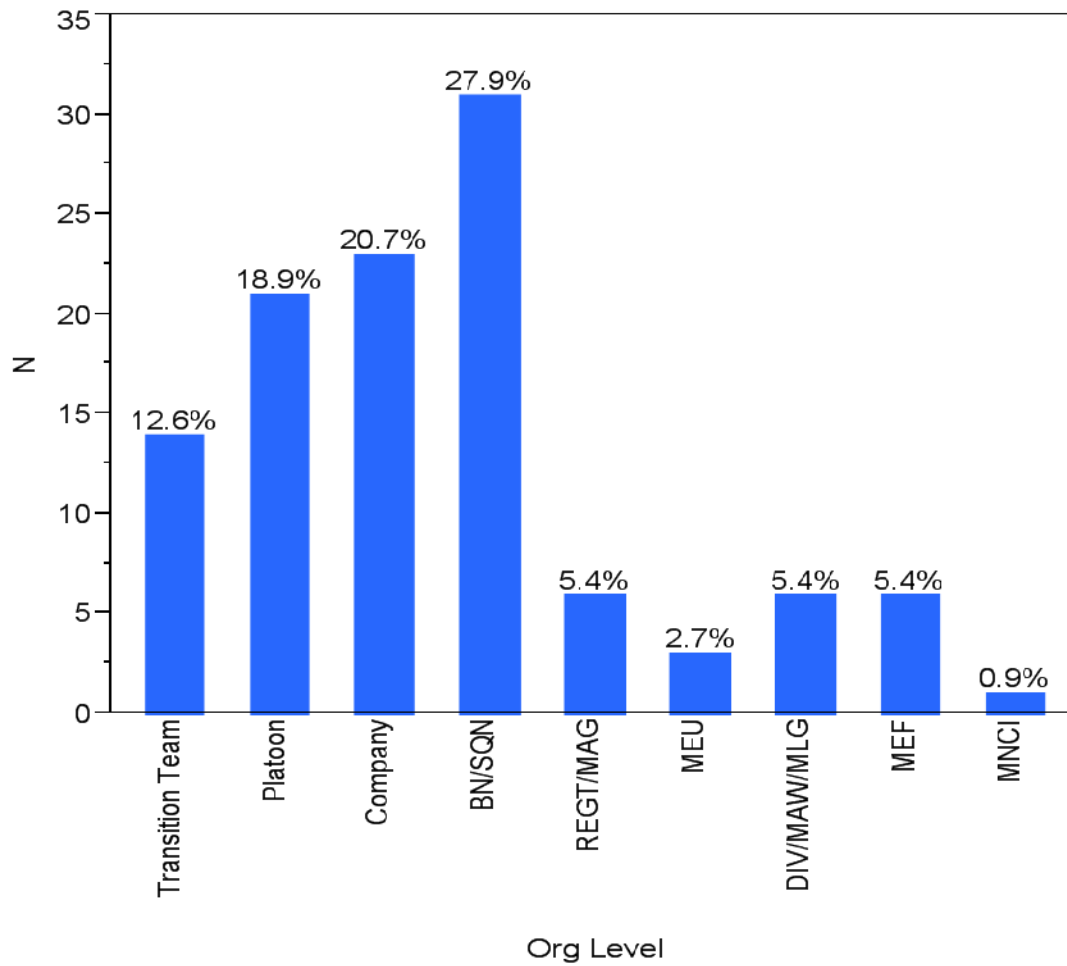
Figure 15.   The distribution of command levels by respondents, where "N" indicates the number of respondents in each category.   The percentage of respondents in each command level out of the total number of respondents is shown at the top of each bar.
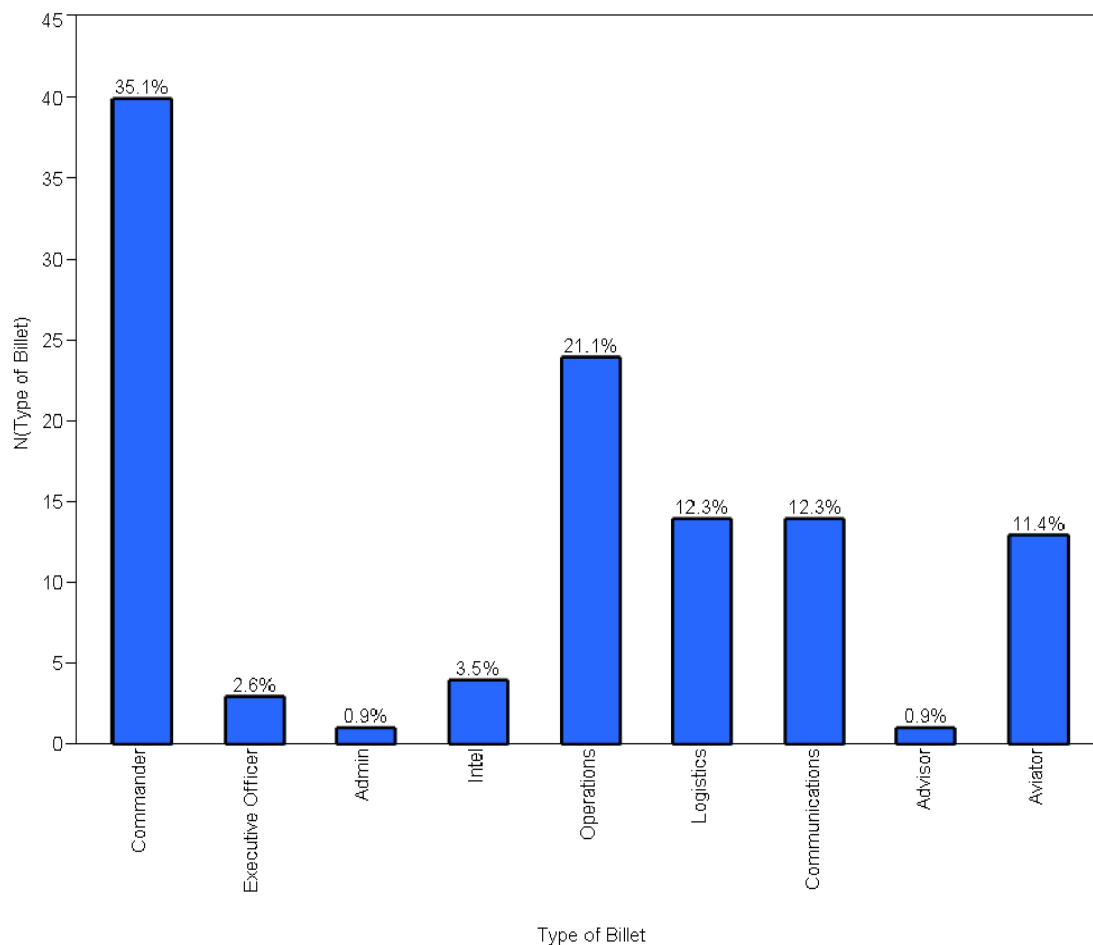
Figure 16.   The   distribution   of   billet   types   by
             respondents,   where   "N"   indicates   the   number   of
             respondents   in   each   category.   The   percentage   of
             respondents   in   each   billet   type   out   of   the   total
             number   of   respondents   is   shown   at   the   top   of   each   bar.

All 114 respondents served in a designated combat zone;
93.9% served in OIF, 31.5% served in OEF and 25.4% served in
both. The number of OIF tours ranged from one to four or
more with one tour (39%) being the most common followed
closely by two tours (33%). Ninety-two percent of OEF
veterans served one tour in Afghanistan. Respondents were
not asked to specify tour length (i.e., seven or fourteen
months).

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For the purposes of this survey, respondents were asked to choose one specific deployment to reference; 80% selected OIF while 20% chose OEF. Respondents identified the year of this deployment with the distribution shown below in Table [1].

2003	2004	2005	2006	2007	2008	2009	2010
1.8	7.1	6.2	16.8	17.7	23.9	23.9	2.7

Table 1.   Year returned from combat deployment where numbers represent percent of sample

When asked if they participated in predeployment training, more than three out of four respondents (79%) stated they partook in collective unit level predeployment training, such as Mojave Viper or a battalion field exercise. Of those who conducted predeployment training, most (71%) served in the same billet during their subsequent deployment. Most officers surveyed (92%) used the BFT and learned through a combination of formal and informal methods. BFT use during predeployment training was rare with almost half of the respondents stating the system was not available to them. Conversely, during their combat deployment, officers' use of BFT increased drastically with most using the system every day or multiple times per day. Figure [17] shows the usage of BFT in predeployment training and combat.

Figure 17.   A comparison of BFT use between training and combat, where "N" indicates the number of respondents in each category. Blue columns indicate BFT use during training while red columns indicate BFT use during combat.

B.   COMMAND AND CONTROL SCENARIO FINDINGS

We compared the officers' own training without (or with limited use of) BFT prior to their deployment against the officers' deployment experiences with BFT to establish a before and after scenario. Most of the officers had recent relevant experience with collective predeployment training that covered similar types of operations to those conducted in OEF/OIF but without or limited use of BFT. Respondents were asked to focus their answers only on the deployment and the associated predeployment training in which they used the

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BFT system the most, or that the BFT had the most impact. This distinction was necessary to create a pairing between training and combat. Data in this section include only responses from officers who both conducted predeployment training *and* filled the same billet during their subsequent combat deployment. Sixty-three respondents met this criterion. Questions focused on such aspects of C2 as frequency of BFT use, frequency of duties taking place outside the wire, push and pull information flow, hierarchical communications, significant event reporting requirements and mission command.

1. BFT Use

BFT use rose significantly in combat. Almost 50% of respondents who had predeployment BFT training stated that BFT was unavailable to them during collective training while the same amount stated they used the system more than once per day in combat. Only 7% stated that BFT was unavailable or they never used the system in combat.

2. Outside the Wire

In order to gain an appreciation of how the BFT was used for C2, respondents were asked to identify how often their billet responsibilities demanded they operate outside the wire. The goal was to limit the C2 systems only to those available to a Marine in a field environment. A minority of officers (13%) never left the wire during training, while 35% did so almost every day. Exactly half the officers conducted operations outside the wire while deployed whereas only 7% never left base. Figure [18] shows the distribution in responses.

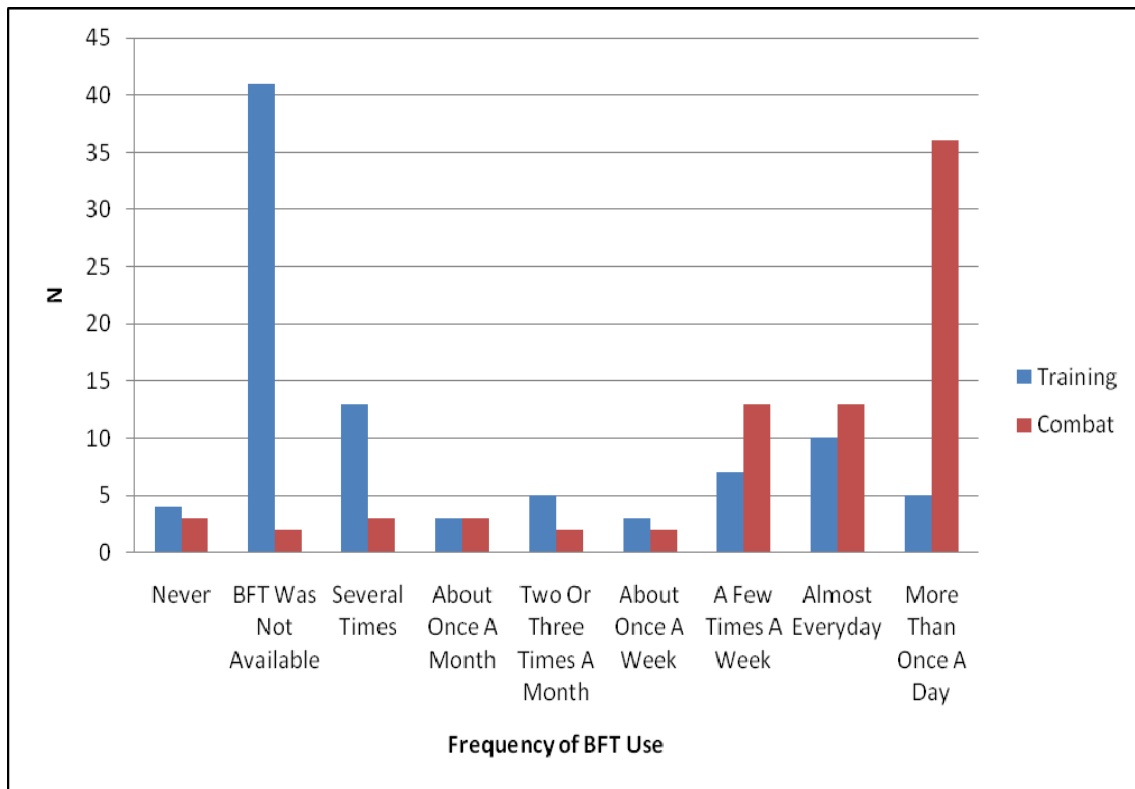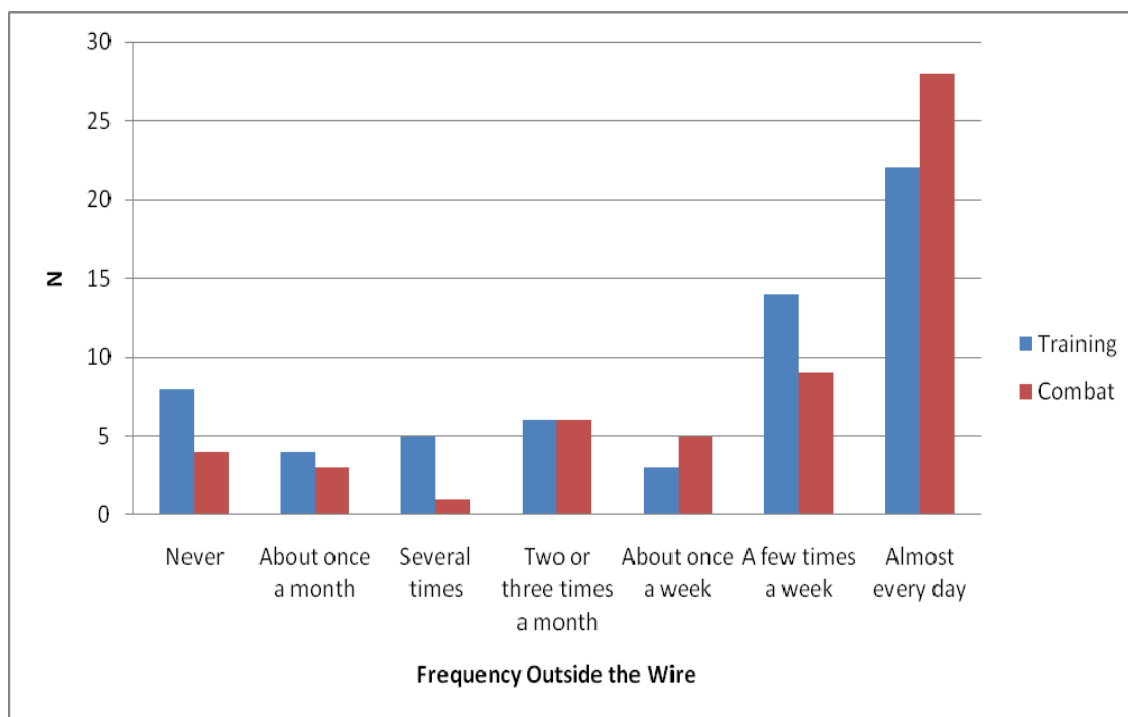Figure 18.   A distribution of outside the wire instances between training and combat, where "N" indicates the number of respondents in each category. Blue columns represent training and red columns indicate combat.

3.   Information Push

No difference was found in information push between training and combat. The majority of respondents (66%) stated that they received information several times per day while operating outside the wire compared with 69% in combat. However, the system used to push this information changed significantly. Radio transmission accounted for 75% of information push during training whereas combat shows an almost even split between radio and BFT with 32% and 34% respectively. Figure [19] displays the use of different communications systems used by Higher Headquarters (HHQ) to push information.
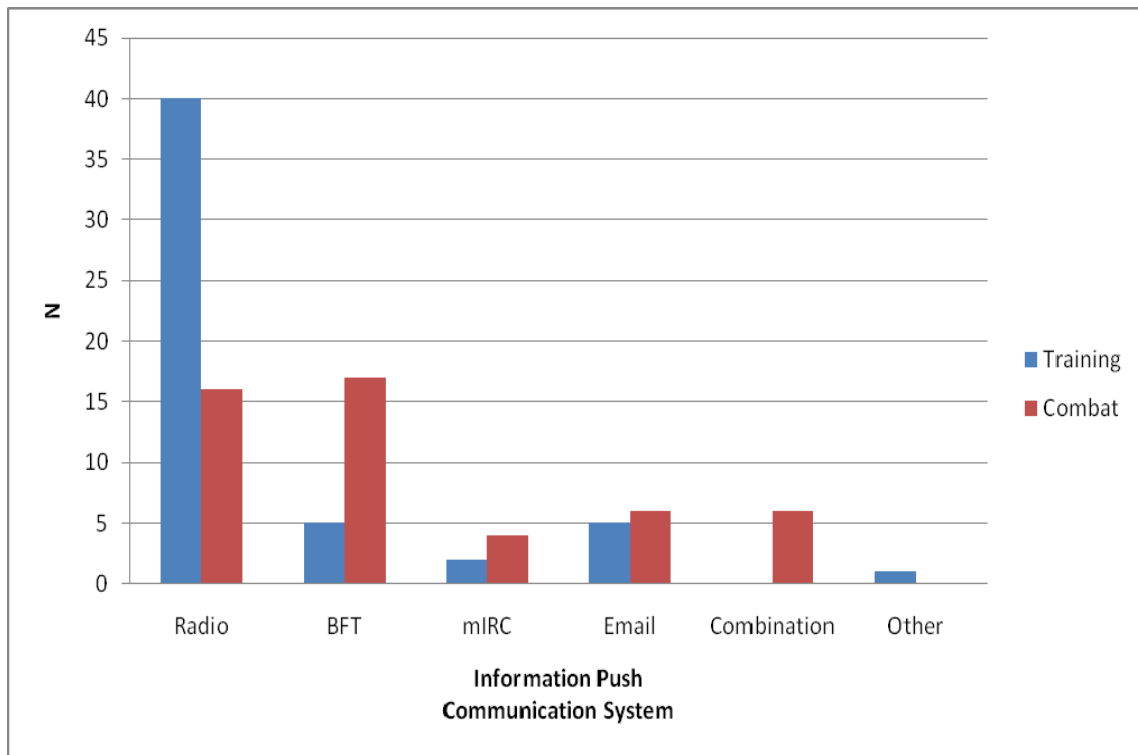
Figure 19.   Distribution of "While operating "outside the wire" which communications system did your HHQ primarily use to push information to you?" where "N" indicates the number of respondents in each category. Blue columns indicate training and red columns represent combat.

4.   Information Pull

Like information push, little difference was found between training and combat with regards to information pull. Most officers (60% in training and 57% in combat) were asked by their HHQ for information outside normal reporting times more than once a day. Radio communications were the primary means of information pull in training (76%) and this again was divided with BFT in combat at 35% and 37%, respectively. Figure [20] shows the distribution of communications systems used by HHQ to pull information.

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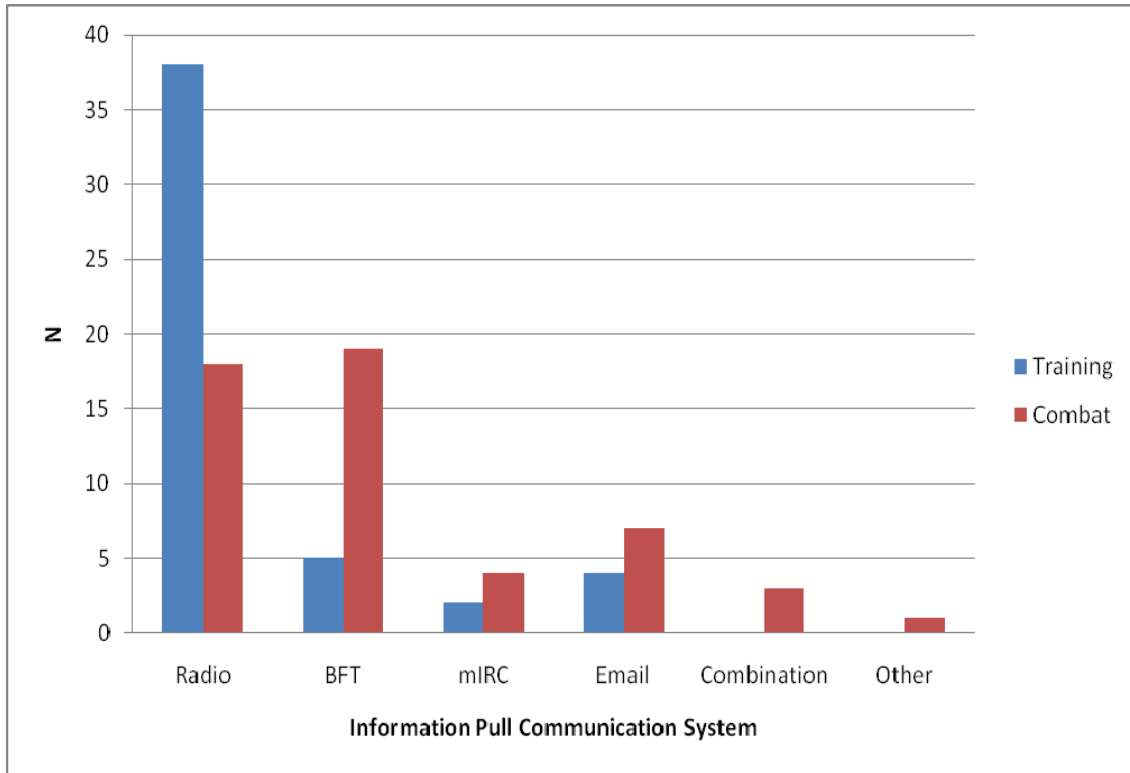
Figure 20.   Distribution of "While operating "outside the wire" which communications system did your HHQ primarily use to pull information to you?" where "N" indicates the number of respondents in each category. Blue columns indicate training and red columns represent combat.

5.   Hierarchical Communications

Officers were asked "How often did you receive orders from a headquarters higher than your immediate command (for example you are a platoon commander and you receive an order directly from your battalion)?" During training, 58% of respondents answered "never" while 18% responded "almost every day." Combat saw a 3% increase in "almost every day" occurrences to 21%, while "never" decreased to 37%. Figure [21] shows the distribution in responses.

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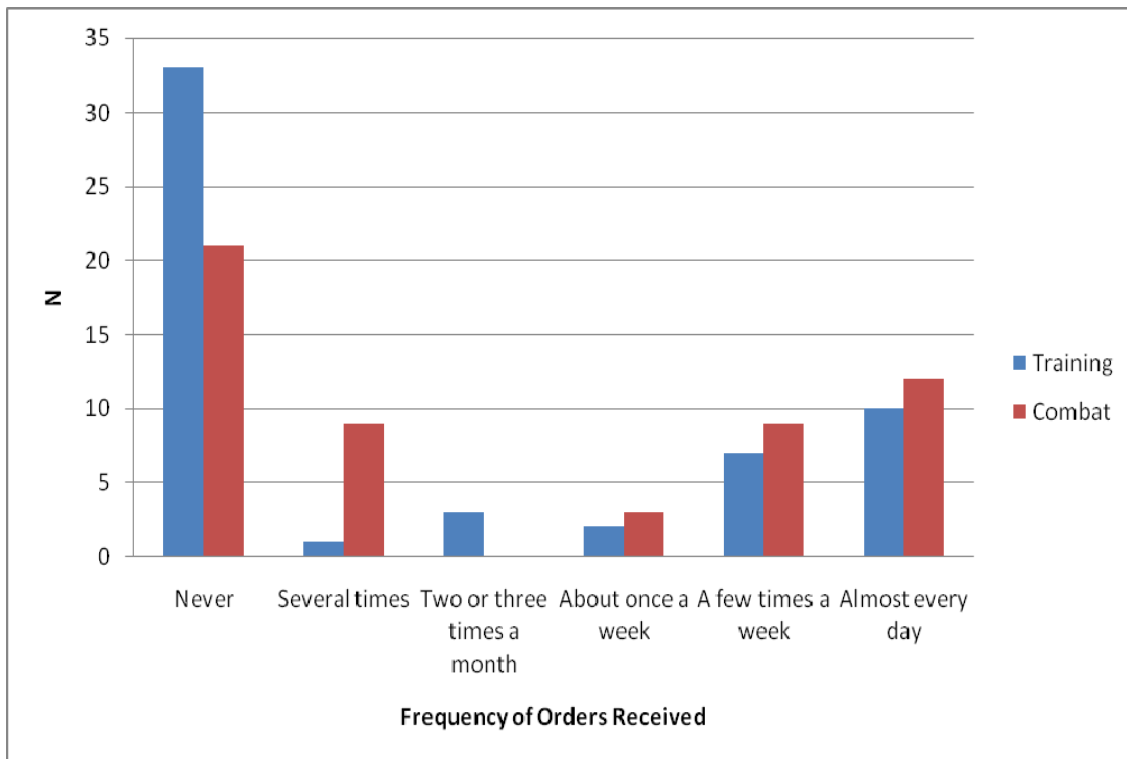
Figure 21.   Distribution of responses to, "How often did you receive orders from a HHQ higher than your immediate command?", where "N" indicates the number of respondents in each category. Blue columns indicate training and red columns represent combat.

6.   Significant Event Reporting

This section of the survey attempted to establish whether or not reporting requirements changed between training and combat. However, due to ambiguous wording in the survey instrument, it was decided not to include responses to this question in the analysis.

7.   Mission Command

Respondents were asked to rate their immediate supervisor's use of mission command on a 1-5 Likert scale with 1 being the worst and 5 the best. Responses for

training showed a 3.82 mean with a 1.17 standard deviation. When asked how their immediate supervisor's use of mission command changed during the deployment, 44% stated there was "no change" while 46% said improvement occurred. Only 10% showed a decline.

In addition to rating their immediate commander, officers also rated their own use of mission command. Officers rated themselves a 3.93 during training and all respondents either noted no change or an improvement during combat. No officers demonstrated a decline.

C. OPINION RESPONSES

Respondents were asked to provide their opinion concerning BFT's impact on C2 and decision making. Presentation of this data differs from section [b] in that these responses are reflective of the entire sample independent of training or combat correlation. To provide a greater understanding of the data, relevant vignettes are included to capture some of the more pertinent narratives supporting and dissenting from the majority position.[4]

1. BFT's Effect on Mission Accomplishment

Of the 64 officers that provided an answer, a majority stated that the inclusion of BFT into their communications architecture improved their ability to accomplish their mission. Only one officer dissented and 25 stated no change. Figure [22] shows BFT's effect on mission accomplishment.

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[4] The rank, operation and year attributed to the vignette reflect the respondent's rank and year of deployment referenced in the survey, not his/her current rank or position.
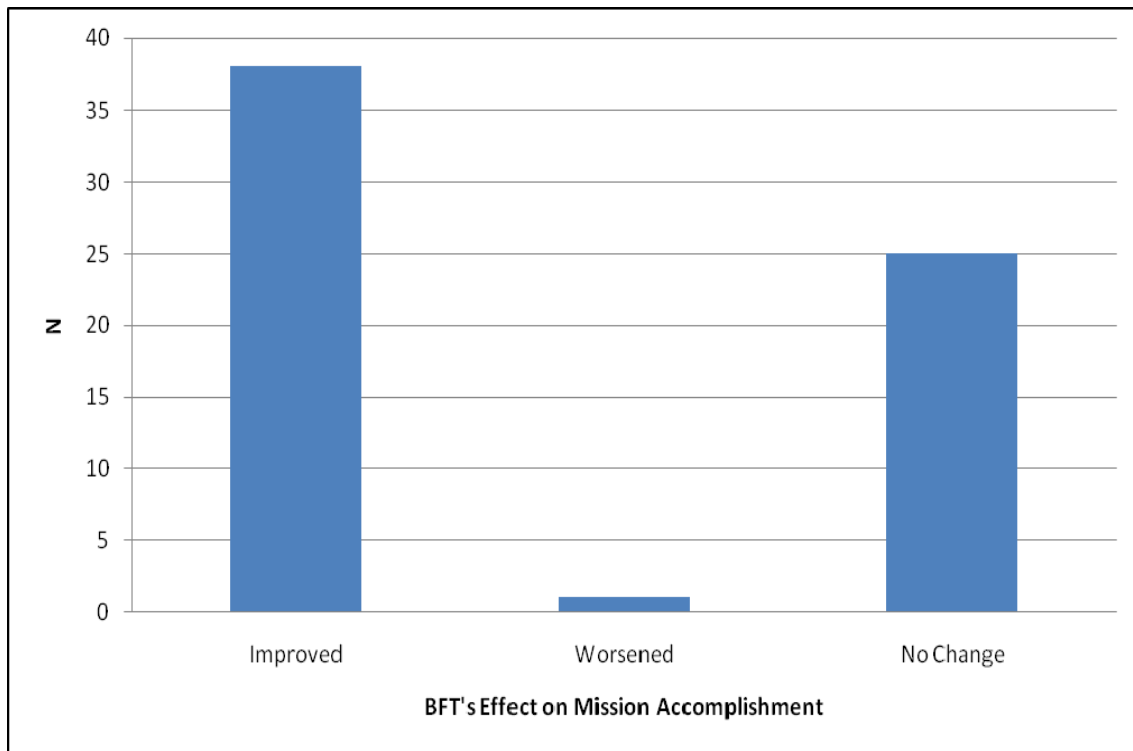
Figure 22.   Distribution   of   responses   to,   "In   your
         opinion, how did the incorporation of BFT into your
         unit's communications architecture affect your ability
         to accomplish your mission?", where "N" indicates the
         number of respondents in each category.

Supporting Vignettes

-"BFT was essential while operating in Afghanistan due to
the vast distances that were covered." (Major, OEF, 2009)

-"BFT is fantastic; secure BFT would be ideal... however,
the big danger is tunneling into the BFT and not observing
your surroundings... becoming a "BFT Zombie" is a big hazard
for a lot of folks." (Capt, OIF, 2007)

-"The mission would have been greatly impeded if the BFT was
not available. The Comms coverage in country was not at a
sustainable level. Multiple unit shifts and unit moves

hindered the ability of our unit to talk directly with the units whose AO we were in." (Maj, OIF, 2008)

-"BFT and the Moving Map Kneeboard for pilots, increased the Situational Awareness of pilots exponentially. The ability to use over the horizon communication to talk to the squadron headquarters help out a lot." (Capt, OEF, 2009)

Dissenting Vignette

-"BFT was used as a crutch. At times "All Hands" info was passed via BFT. When I or Marines in my command were not vehicle mounted they would not receive the information. In a follow-on deployment my unit was the only foot mobile company. As a result we lacked significant situational awareness of events and Bn Traffic because we were not privy to the BFT traffic." (Capt, OIF, 2006)

2. Hierarchy Changes

A total of 79 officers responded to this question; however, because the survey did not include a multiple choice option, we classified each narrative response into "Yes," "No" or "Depends." We were unable to classify eight of the responses leaving 71 usable answers. When asked if leaders should adjust C2 architecture at the tactical level to exploit the capabilities offered by BFT, almost 82% stated no. Figure [23] shows the results.
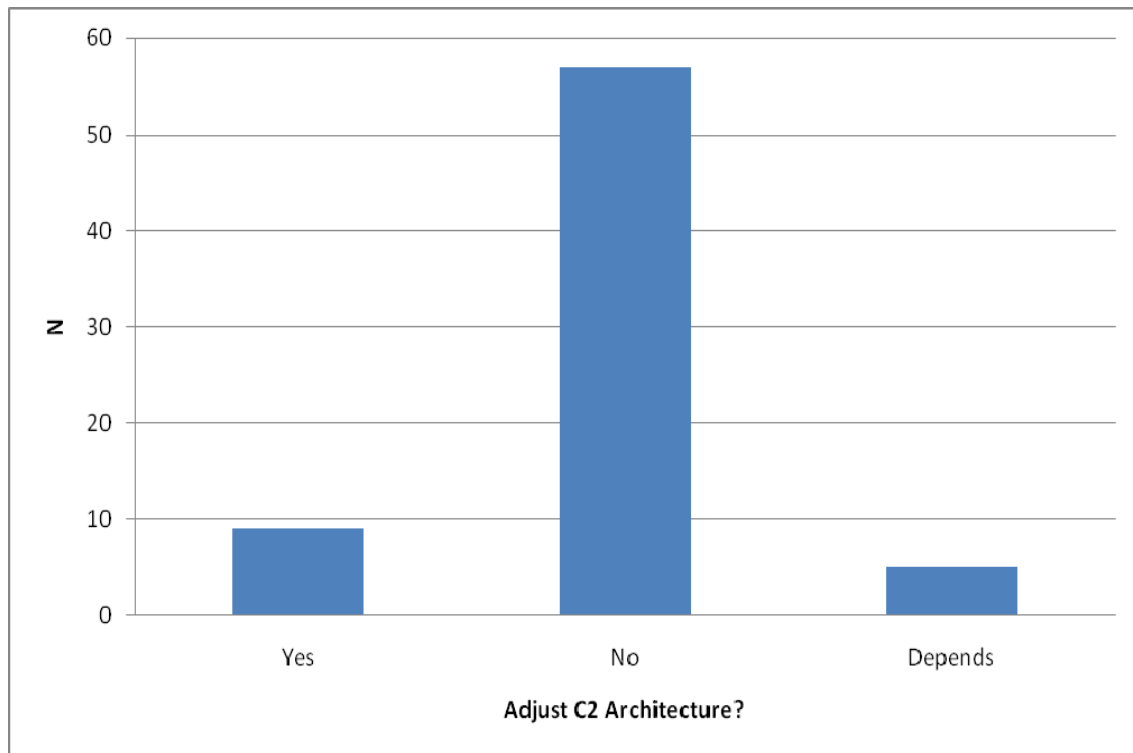
Figure 23.   Distribution   of   responses   to,   "Should
    leaders adjust command and control architecture at the
    tactical level to exploit the capabilities offered by
    BFT (For example, flattening the organization by
    eliminating a layer of command), or should traditional
    hierarchies be kept in place?" where "N" indicates the
    number of respondents in each category.

Supporting Vignettes

-"Maintain traditional hierarchies. It is still much more
effective for a Battalion to concern themselves with 3-4
maneuver elements, with subordinate maneuver elements than
to try and individually manage 10-20 platoon and squads
roaming through the battle space. Companies can effectively
provide organic support as required for most significant
events (i.e., QRF request), and request additional support
from Bn if necessary or more resources required (i.e., Heavy

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QRF with Tanks)—but Battalion could quickly become overloaded Co level COC removed from common operational picture." (1stLt, OIF, 2009)

-"Keep traditional hierarchies or collect every MCDP-1 and burn it!" (1stLt, OIF, 2006)

-"leave tactical hierarchies in place. BFT reports position location and additional information as transmitted by the sender. It does not enhance higher HQ's situational awareness to the point that it is practical or advisable to eliminate a layer in the chain of command." (Capt, OEF, 2009)

-"Absolutely not. Roles at various levels of command cannot be addressed through a flattened command hierarchy. HHQ's perspective is enhanced through BFT, but nonetheless restricted in its scope. Promulgating commands via BFT to subordinate units is only communication; command is much broader than communication alone." (1stLt, OIF, 2005)

Dissenting Vignettes

-"Heck, if BFT can be used as another reason to trim fat off of the typically bloated HHQ personnel staffing... run with it." (Maj, OIF, 2007)

-"I would have to say it's all situational dependent- Yes, there will be several occasions when this will be beneficial for a mission to succeed. The more centralized a command is at the tactical level while conducting distributed operation, the greater chance you have in losing momentum. Pushing control to the lower levels (if they are properly trained) can be a force multiplier. Traditional hierarchies functions only if they are not violated—there must be unity

of command and more importantly, the subordinate units need to know who is in charge." (1stLt, OIF, 2009)

3. BFT's Effect on Tactical Level Decision Making

A total of 64 respondents provided an answer. The majority (52%) feel the BFT system has no impact on decision rights. For those officers that did notice a change, 37% said that decision rights have shifted to senior leaders. Only 11% believe the BFT has shifted decision rights down the chain of command. No additional comments were provided for this question; therefore, no vignettes are included. Figure [24] shows BFT's impact on decision rights.
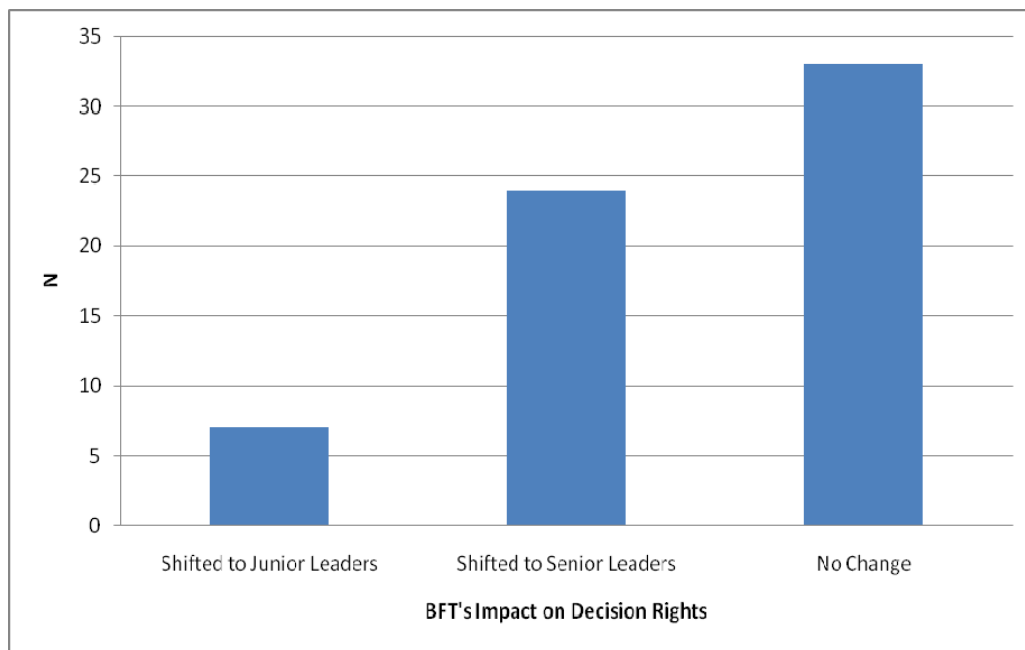
Figure 24.   Distribution of responses to, "With the inclusion of BFT, it's possible that decision rights at the tactical level have shifted down the chain of command or it's possible that they've shifted up the chain of command with senior officers assuming a more active management role due to their increased situational awareness. In your opinion, how have decision rights been affected by BFT?" where "N" indicates the number of respondents in each category.

Further analysis revealed that many of respondents who feel decision rights have shifted to senior leaders are aviators. Therefore, we further categorized the respondents into "Aviator" and "Ground" based on their demographic data.[5] This categorization reduced the sample from 64 to 58 (12 aviator/46 ground) usable responses. When we included this variable, the data shows aviators disproportionally (83%) believe decision rights shifted to senior leaders compared to 65% of ground officers who believe the BFT has not affected decision rights. Figure [25] shows the distribution of responses between ground officers and aviators.
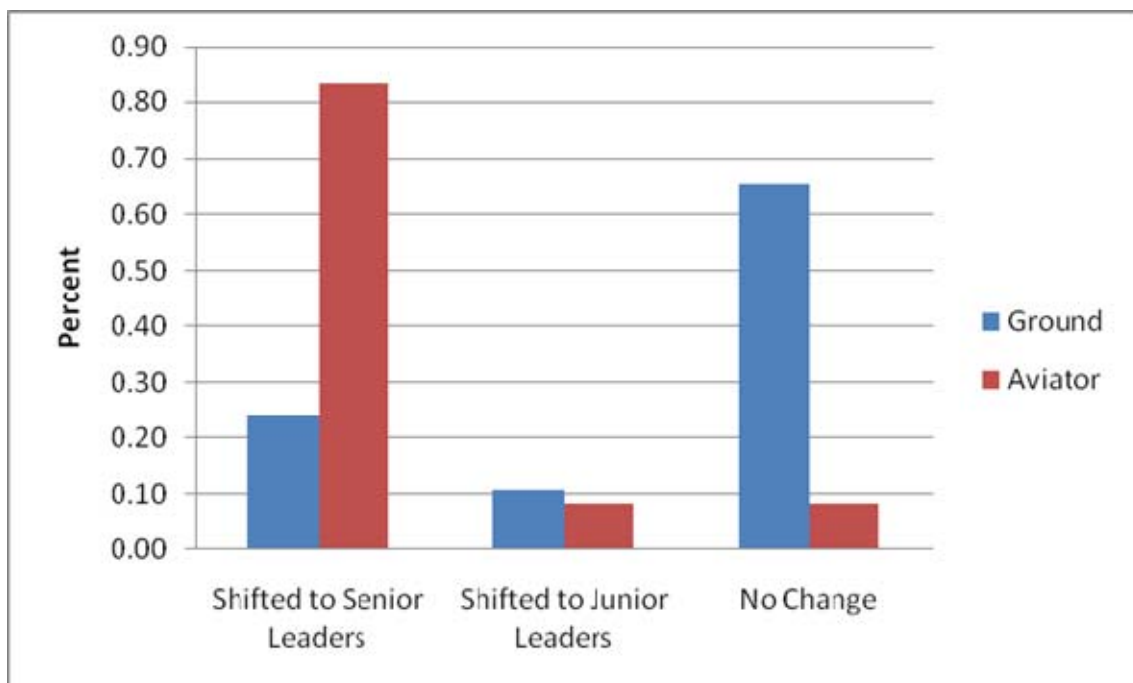
Figure 25.   Percentage distribution of responses categorized by ground or aviation

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[5] The term "Aviator" only applies to those respondents with a corresponding MOS (i.e., 7566, 7588, etc). Ground based aviation related MOSs were placed in the "Ground" category.

Fisher's Exact test for quantitative statistical analysis is used for this question to determine if there are nonrandom associations between two categorical variables (23). The test showed a statistically significant difference (p < .0001) between Aviators and Ground MOS how decision rights have shifted to senior leaders.

4.   Greater Autonomy at the Tactical Level

Respondents were asked, "Do you feel BFT allows for greater autonomy in decision making at the tactical level? Why or why not?" Since this question did not offer a multiple choice (yes or no) option in the survey form, narratives were evaluated to categorize the responses into "Yes," "No" and "Depends." A total of 82 respondents provided an answer; however, 13 did not contain sufficient information to make a categorical determination, leaving 69 usable answers.

Forty-six percent of respondents feel that BFT does not allow for greater autonomy in decision making at the tactical level while 42% believe it does and 11% think it depends. Figure [26] illustrates this distribution.
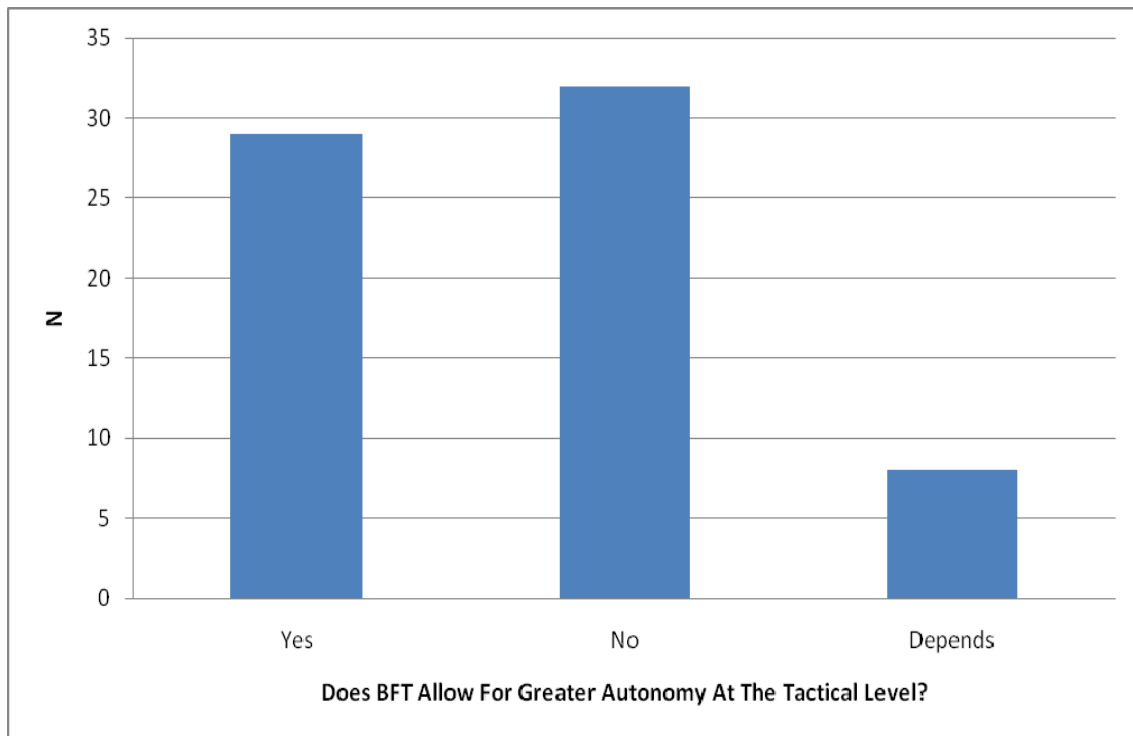
Figure 26.   Distribution of responses to "Do you feel BFT allows for greater autonomy in decision making at the tactical level?" where "N" indicates the number of respondents in each category.

When accounting for operation (OEF/OIF) referenced in the survey, we found a significant difference at the .05 level of significance between OEF and OIF focused respondents' opinions. Where OIF focused respondents were almost evenly matched in their opinions, 71% of OEF focused respondents feel the BFT did not enable greater decision making at the tactical level compared to 29% who did. Figure [27] shows the results.
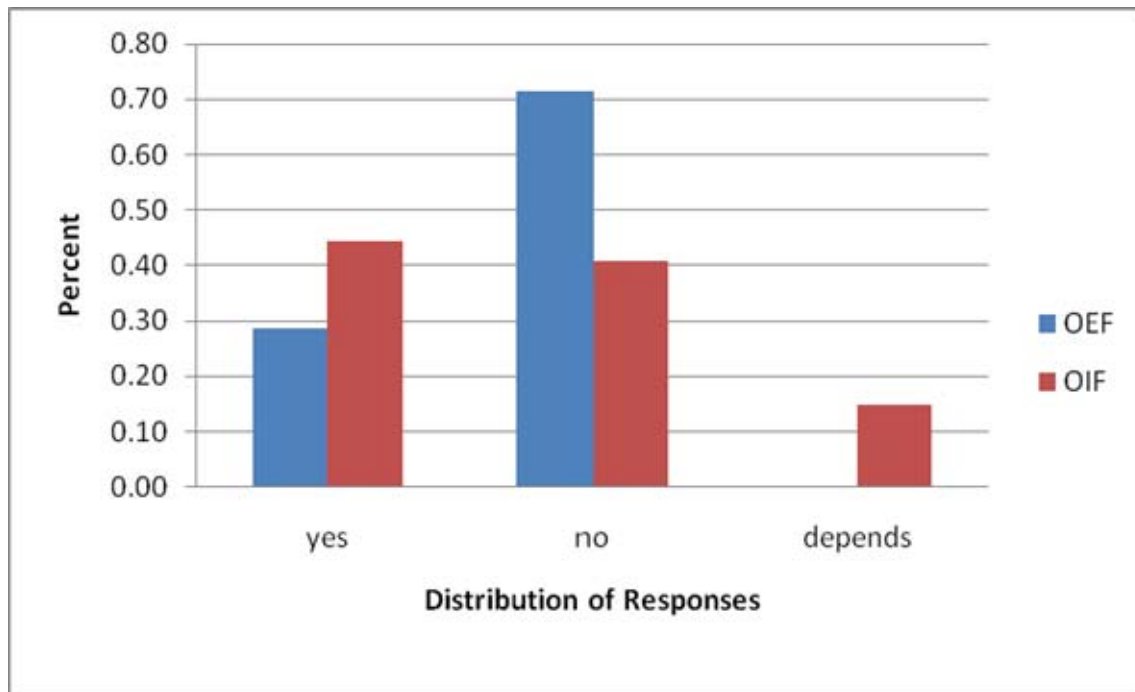
Figure 27.   The graph of "Do you feel BFT allows for greater autonomy in decision making at the tactical level?" as analyzed by the country of focus for this survey.

These results were surprising as the BFT system is homogenous between theaters. Further analysis revealed that the majority of OEF focused respondents who claimed that BFT did not allow for greater autonomy at the tactical level are aviators. Therefore, we factored in whether or not the response originated from an aviator or ground based respondent. This further categorization decreased from 69 to 66 (15 Aviator/51 Ground) the number of eligible responses to this question; however, when accounting for an Aviator or Ground MOS, we found a statistically significant difference at the .05 statistical level between responses. Officers with ground MOSs are almost evenly split with roughly half stating "Yes" and about a third stating "No" with the remainder choosing "Depends." Conversely, almost 87% of

Aviators believe that the BFT does not allow for greater autonomy at the tactical level. Results are shown in Figure [28].
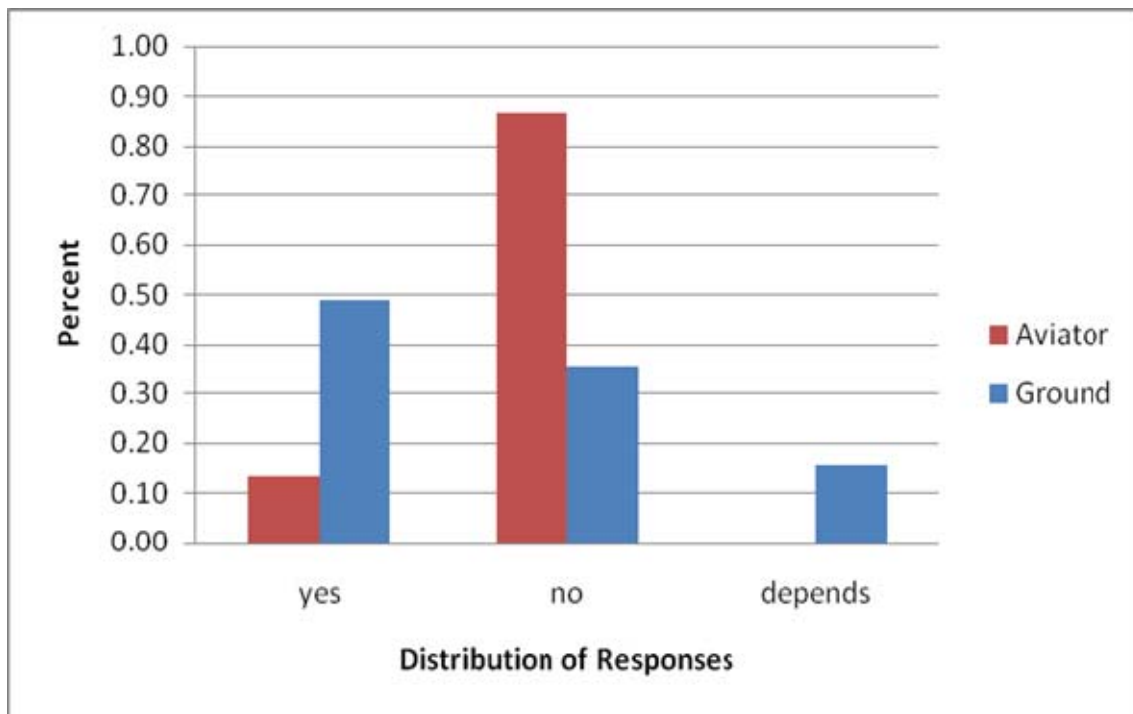
Figure 28.   The graph of "Do you feel BFT allows for greater autonomy in decision making at the tactical level?" as analyzed by Aviator and Ground categorization.

Supporting Vignettes

-"I do not. In fact, at the tactical level you tend to be more micro managed and second guessed by higher headquarters largely because an icon on the screen doesn't always tell you what is going on therefore they tend to want more information." (Maj, OEF, 2009)

-"No. It creates conditions where leaders monitoring the various nets are able to second guess and "armchair quarterback" your decisions, as it is employed. I think it

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offers the potential for greater autonomy, but many leaders use it as a micromanagement tool." (Capt, OEF, 2009)

-"No. There are several advantages associated with the BFT, however in my opinion the best opportunities for decision making are with the commander on-site. In some cases the BFT could contribute to confusion if a higher level of command is viewing a situation based on a screen capture and subordinate leaders have a different perspective on the ground."

Dissenting Vignettes

-"It does. It gives the tactical unit leader a common operating picture of friendly unit positions and potential danger areas (IEDs, etc) and other graphical information that aids in battlespace awareness. With this awareness, the leader can make better decisions at his/her level." (Maj, OIF, 2008)

-"Yes, it could because of increased situational awareness so that commanders at lower levels are able to make decisions without having to go through HHQ to get the information." (1stLt, OIF, 2006)

Inconclusive Vignettes

-"Yes and no; greatly depending on the Commander. I often found the BFT created a data hungry environment, where answers were expected immediately as a tactical situation was unfolding. There needs to be considerable thought put in place as to 'how' to communicate effectively with the BFT. Point and click messaging doesn't mean instant understanding of the situation." (Capt, OIF, 2007)

-"Situationally dependent. A leader that doesn't exercise mission C2 is not going to regardless of the technology offered." (Capt, OIF, 2004)

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V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The evidence is inconclusive as to FBCB2-BFT's influence on C2 and decision making in an operational environment at the tactical level (Marine Corps battalion and below). Analysis of the survey respondents' before and after answers does not demonstrate any statistically significant difference in how C2 and decision making occur with and without FBCB2-BFT. This is surprising given the amount of literature and OIF after action reports testifying to the system's transformational impact on these two areas. Although respondents noted an increased use of the system in combat, they did not articulate a change in the amount of information exchanged with their immediate HQ or in the amount of orders received from a HQ higher than their own. While the means with which this information was exchanged shifted during combat (increased use of FBCB2-BFT, decreased use of radio), the frequency of these exchanges remained relatively constant indicating the system has little effect on the C2 style of the commander. This is reinforced by the lack of a statistically significant difference in the respondents' ratings of their immediate commander's use of mission C2 between training and combat. This, too, is surprising given the commander's ability to exploit the SA and communications aspects of FBCB2-BFT and bypass subordinate leaders. However, these findings are not universal throughout the sample as will be discussed below.

The impact of FBCB2-BFT on decision rights is interesting in that very few (11%) of the respondents feel the system facilitates a shift of decision-making responsibilities to junior leaders. This is in contrast to 37% who feel that decision rights have actually shifted to senior leaders and over half (52%) who feel that the system has no effect on decision rights. The small proportion of officers who believe the BFT has shifted decision rights to junior leaders would indicate that most officers do not feel the system improves decentralized decision making. However, the majority (82%) belief that traditional hierarchies should remain in place would indicate that the Marine Corps should continue to operate within the hierarchical decision-making model even though FBCB2-BFT is not empowering the junior leader.

The effect of FBCB2-BFT on autonomy follows a similar pattern. The almost even split between those respondents who feel the system allows for greater autonomy (44%) and those who do not (46%), with 11% stating that it depends, was surprising. Given the small number of respondents who feel that decision rights have shifted to junior leaders, it was expected that a similar proportion of officers would feel the system allows for greater autonomy.

However, by analyzing these findings by whether or not the respondent was an aviator, there is a statistically significant difference in both categories. These findings help generate and evaluate the alternative hypothesis (H_a): There is a significant difference between how aviators and ground based MOSs use the BFT.

The results support the alternative hypothesis that there are significant differences between how aviators and ground based MOSs use the BFT. Environmental variables not addressed in the survey may affect or account for this difference. For instance, it is possible that many of the respondents were members of the same unit and shared the same commander. Additionally, organizational and cultural factors uniquely associated with the aviation community have not been addressed. While this thesis focused on the tactical level, specifically battalion and below, it does not delineate between flying squadrons and ground battalions. Both exist at the O-5 command level, however, few would argue that they are identical in their command climate, culture and organizational structure.

Other limitations of the convenience sample preclude generalization to the entire Marine Corps and particularly to enlisted Marines. Additionally, it should be noted that the combat experiences of the respondents took place disproportionally during counter-insurgency operations. This distinction is important as other research has focused on the use of FBCB2 and FBCB2-BFT during the "combat" phase of OIF and have come to significant conclusions about the efficacy of the system.[6]

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[6] For a comprehensive analysis see, "A Network Centric Operations Case Study: US/UK Coalition Combat Operations during Operation Iraqi Freedom" Evidence Based Research, Inc. 2004.

B. RECOMMENDATIONS FOR FUTURE RESEARCH

1. Additional Research into the Differences Between Ground and Aviation MOSs

The statistically significant findings between aviator and ground officers' use of the system provides a foundation for future research. Controlling for such factors as mission, platform, experience, etc., may help explain why this difference exists. These findings could help determine future variants of the system (for instance, fixed wing or rotary wing versions of the system) and fielding quotas.

2. Expand the Sample to Include Enlisted Marines

Limiting our research to a convenience sample or officers precluded the inclusion of enlisted Marines in our data. At approximately 90% of the total Marine Corps population (U.S. Marine Corps, 2009), capturing this demographic is critical in understanding FBCB2-BFT's impact on the entire chain of command.

3. Analyze FBCB2-BFT Use Across the Spectrum of Conflict

While C2 and decision making are ubiquitous across the spectrum of conflict, the way information systems are used may differ depending on the type of operation. As previously discussed, FBCB2-BFT allows for increased operational tempo during high intensity conflict; however, how do commanders exploit its capabilities during more permissive operations such as humanitarian assistance and disaster relief? Findings from this analysis can provide a more nuanced view of the system and help determine which capabilities should be included in future versions.

APPENDIX: THE SURVEY INSTRUMENT

Procedures. This is an online survey as part of a masters thesis which will ask questions focusing on your training and combat experiences and your use of command and control systems. The survey will take about 10 minutes to complete.

Voluntary Nature of the Study. Your participation in this study is strictly voluntary. If you choose to participate you can change your mind at any time and withdraw from the study. You will not be penalized in any way or lose any benefits to which you would otherwise be entitled if you choose not to participate in this study or to withdraw.

Potential Risks and Discomforts. There are no potential risks of participating in this study.

Anticipated Benefits. Anticipated benefits from this study are an increased knowledge of how command and control systems are used at the tactical level and how to improve such systems in the future. You will not directly benefit from your participation in this research.

Compensation for Participation. No tangible compensation will be given. A copy of the research results will be available at the conclusion of the experiment through the NPS library.

Confidentiality & Privacy Act. Any information that is obtained during this study will be kept confidential to the full extent permitted by law. All efforts, within reason, will be made to keep your personal information in your research record confidential but total confidentiality cannot be guaranteed.

Points of Contact. If you have any questions or comments about the research, or you experience an injury or have questions about any discomforts that you experience while taking part in this study please contact the Principal Investigator, Dr. Ronald Fricker, 831-656-3048 , rdfricke@nps.edu. Questions about your rights as a research subject or any other concerns may be addressed to the Navy Postgraduate School IRB Chair, Dr. Angela O'Dea, 831-656-3966, alodea@nps.edu.

* 1. Please acknowledge your consent

◯ I have read the above and agree to take part in this survey

2. Have you served in a combat zone?

◯ Yes

◯ No

3. Have you served in Iraq?

◯ Yes

◯ No

4. How many separate Iraq deployments?

◯ 1

◯ 2

◯ 3

◯ 4 or more

5. Have you served in Afghanistan?

◯ Yes

◯ No

6. How many separate Afghanistan deployments?

○ 1

○ 2

○ 3

○ 4 or more

If you have completed more than one deployment, for the remainder of the survey, please focus your answers only on the deployment and the associated predeployment training in which you used the BFT system the most or that the BFT had the most impact.

Questions are written in the singular and will refer to "this combat deployment" or simply "combat deployment".

7. In which country was this combat deployment?

○ Iraq

○ Afghanistan

8. What month and year did you return from this combat deployment?

	Month	Year
Date		

9. During this combat deployment, what was the highest rank you achieved?

○ O-1

○ O-2

○ O-3

○ O-4

○ O-5

○ O-6

10. For the majority of this combat deployment, what type of billet did you fill?

	PLT	CO	BN/SQN	REGT/MAG	MEU	MEB	DIV/MAW/MLG	MEF	Transition Team
Commander	☐	☐	☐	☐	☐	☐	☐	☐	☐
Executive Officer	☐	☐	☐	☐	☐	☐	☐	☐	☐
Admin	☐	☐	☐	☐	☐	☐	☐	☐	☐
Intel	☐	☐	☐	☐	☐	☐	☐	☐	☐
Operations	☐	☐	☐	☐	☐	☐	☐	☐	☐
Logistics	☐	☐	☐	☐	☐	☐	☐	☐	☐
Communications	☐	☐	☐	☐	☐	☐	☐	☐	☐
Watch Officer	☐	☐	☐	☐	☐	☐	☐	☐	☐
Aviator	☐	☐	☐	☐	☐	☐	☐	☐	☐

Other (please specify)

Force XXI Battle Command Brigade and Below (FBCB2) or Blue Force Tracker (BFT) is a communication platform designed for commanders to track friendly and hostile forces on the battlefield. It increases a commander's situational awareness of the battlefield by gathering information graphically instead of collecting reports verbally. The BFT system has been incorporated into thousands of combat vehicles (e.g., tanks, infantry fighting vehicles, and High Mobility Multipurpose Wheeled Vehicle). It allows individuals to exchange voice, video, or other data securely, and to gain access to terrain maps, logistics information, and a shared situational awareness display indicating the location of friendly and enemy units.

11. Have you used BFT?

◯ Yes

◯ No

12. How did you learn to use BFT?

◯ Formal training

◯ Hands on experience

◯ A combination of formal and informal training

◯ Self taught

◯ Other (please specify)

[   ]

The objective of this next section is to establish a decision making authority baseline (without BFT). This section will focus on determining if BFT was used during unit level pre-deployment training. The goal is to establish how a unit exercised command and control during collective training. Collective training is instruction and training that prepare an organizational team to complete required tasks as a unit. An example of collective training is an infantry platoon's assault on a fortified position.

13. Did you conduct unit level pre-deployment training (battalion field exercise, Mojave Viper, etc.) for this combat deployment?

◯ Yes

◯ No

14. Did you serve in the same type of billet during the subsequent deployment?

◯ Yes

◯ No

15. During your unit level pre-deployment training, how often did you use BFT?

○ More than once a day

○ Almost every day

○ A few times a week

○ About once a week

○ Two or three times a month

○ About once a month

○ Several times during the training

○ FBCB2 was not available to me during pre-deployment training

○ Not Applicable

While no doctrinal definition exists for the term, "outside the wire," for the purposes of this survey it is loosely defined as operations conducted off an established forward operating base. Examples of outside the wire operations include: patrols; convoys; route clearance; engineering; close air support, etc. Temporary combat outposts and patrol bases can be considered outside the wire.

16. During your pre-deployment collective training, on average, how often did your billet responsibilities demand that you operate "outside the wire"?

○ Almost every day

○ A few times a week

○ About once a week

○ Two or three times a month

○ About once a month

○ Several times during the training

○ Never

17. During your pre-deployment unit level training, while operating "outside the wire", which communications systems did you primarily receive orders from higher headquarters (HHQ)?

☐ Radio

☐ BFT

☐ mIRC chat

☐ Email

☐ Not Applicable

Other (please specify)

_____

18. During your pre-deployment unit level training, while operating "outside the wire", on average, your HHQ pushed information to you

○ Several times per day

○ Once a day

○ Several times per week

○ Once a week

○ Never

19. During your pre-deployment unit level training, while operating "outside the wire" which communications system did your HHQ primarily use to push information to you?

○ Radio

○ BFT

○ mIRC

○ Email

○ Other (please specify)

_____

20. During your pre-deployment unit level training, while operating "outside the wire", on average, how often did your HHQ pull information from you outside of predetermined reporting times?

◯ Several times per day

◯ Once a day

◯ Several times per week

◯ Once a week

◯ Never

21. During your pre-deployment unit level training, while operating "outside the wire" which communications system did your HHQ primarily use to pull information from you?

◯ Radio

◯ BFT

◯ mIRC

◯ Email

◯ Other (please specify)

[   ]

22. During your predeployment training, how did you primarily communicate with your subordinate units that were operating "outside the wire."

◯ Radio

◯ BFT

◯ mIRC

◯ Email

◯ Not Applicable

◯ Other (please specify)

[   ]

Many commanders will establish their critical information requirements (CCIR) for the purposes of an exercise or deployment. Examples of CCIRs could be as dramatic as the injury or death of a Marine or as routine as fuel stores falling below 75%. During Operation Iraqi Freedom and Operation Enduring Freedom, the term "significant event" was used almost synonymously with CCIR. Theater commanders established guidelines for reporting requirements and timelines. Subordinate commanders would then refine their own guidelines to conform with HHQ.

23. During your pre-deployment unit level training, your HHQ required you to report significant events _____ minutes after the incident occurred.

	5 Min	10	15	20	30	30-60	60 or More	N/A
Reporting Time	◯	◯	◯	◯	◯	◯	◯	◯

Other (please specify)

[   ]

24. During your pre-deployment unit level training, how did you primarily communicate significant events to your HHQ?

◯ Radio

◯ BFT

◯ mIRC

◯ Email

◯ Not Applicable

◯ Other (please specify)

[   ]

25. During your pre-deployment unit level training, on average, how often did you receive orders from a HHQ higher than your immediate command (for example, you are a platoon commander and you received an order directly from your battalion).

◯ Almost every day

◯ A few times a week

◯ About once a week

◯ Two or three times a month

◯ About once a month

◯ Several times during the training

◯ Never

26. How did the HHQ primarily communicate the order?

○ Face to face

○ Radio

○ BFT

○ mIRC

○ email

○ Other (please specify)

[   ]

MCDP-6 states "Mission command and control relies on the use of mission tactics in which seniors assign missions and explain the underlying intent but leave subordinates as free as possible to choose the manner of accomplishment."

27. During your pre-deployment unit level training, how well did your immediate commander exercise Mission Command?

	1 Poor	2	3	4	5 Excellent	N/A
Mission Command	○	○	○	○	○	○

28. During your pre-deployment unit level training, how well did you exercise Mission Command?

	1 Poor	2	3	4	5 Excellent	N/A
Mission Command	○	○	○	○	○	○

The next section will focus on decision making authority with BFT during combat. The goal is to establish how a unit exercised command and control with BFT in a combat environment.

29. During your combat deployment, on average, how often did you use BFT?

○ More than once a day

○ Almost every day

○ A few times a week

○ About once a week

○ Two or three times a month

○ About once a month

○ Several times during the deployment

○ Never

○ Not applicable. BFT was not available to me during deployment

30. During this combat deployment, what was your level of expertise with BFT?

	1 Unfamiliar	2	3	4	5 Expert
Level of expertise	◯	◯	◯	◯	◯

31. During your combat deployment, on average, how often did your billet responsibilities demand that you operate "outside the wire"?

◯ Almost every day

◯ A few times a week

◯ About once a week

◯ Two or three times a month

◯ About once a month

◯ Several times during the deployment

◯ Never

32. During your combat deployment, while operating "outside the wire", which communications systems did you primarily receive orders from higher headquarters (HHQ)?

◯ Radio

◯ BFT

◯ mIRC chat

◯ Email

◯ Not Applicable

◯ Other (please specify)

[   ]

33. During your combat deployment, while operating "outside the wire", on average, your HHQ pushed information to you

◯ Several times per day

◯ Once a day

◯ Several times per week

◯ Once a week

◯ Never

34. Which communications system did your HHQ primarily use to push information to you?

◯ Radio

◯ BFT

◯ mIRC

◯ Email

◯ Other (please specify)

[   ]

35. During your combat deployment, while operating "outside the wire", on average, how often did your HHQ pull information from you outside of predetermined reporting times?

◯ Several times per day

◯ Once a day

◯ Several times per week

◯ Once a week

◯ Never

36. Which communications system did your HHQ primarily use to pull information from you?

◯ Radio

◯ BFT

◯ mIRC

◯ Email

◯ Other (please specify)

[   ]

37. During your combat deployment, how often did you receive orders from a HHQ higher than your immediate command (For example, you are a platoon commander and you received an order directly from your battalion).

◯ Almost every day

◯ A few times a week

◯ About once a week

◯ Two or three times a month

◯ About once a month

◯ Several times during the deployment

◯ Never

38. How did the HHQ primarily communicate the order?

◯ Face to face

◯ Radio

◯ BFT

◯ mIRC

◯ Email

◯ Other (please specify)

[   ]

39. During your combat deployment, your HHQ required you to report significant events _____ minutes after the incident occurred.

	5 Min	10	15	20	30	30-60	60 or More	N/A
Reporting Time	◯	◯	◯	◯	◯	◯	◯	◯

Other (please specify)

[   ]

40. During your combat deployment, how did you primarily communicate significant events to your HHQ?

○ Radio

○ BFT

○ mIRC

○ Email

○ Not Applicable

○ Other (please specify)

[   ]

41. During your combat deployment, how did your immediate commander's use of Mission Command or Mission Type Orders change from predeployment training?

	1 Worsened	2	3 No Change	4	5 Improved	N/A
Mission Command	○	○	○	○	○	○

42. During your combat deployment, how did your use of Mission Command change from your predeployment traning?

	1 Worsened	2	3 No Change	4	5 Improved	N/A
My Mission Command	○	○	○	○	○	○

This next section will focus on your opinions regarding BFT and Command and Control Systems in general.

43. In your opinion, how did the incorporation of BFT into your unit's communications architecture affect your ability to accomplish your mission?

	Worsened		No Change		Improved
BFT Impact on Mission Accomplishment	○	○	○	○	○

Additional Comments

[   ]

44. With the inclusion of BFT, it's possible that decision rights at the tactical level have shifted down the chain of command or it's possible that they've shifted up the chain of command with senior officers assuming a more active management role due to their increased situational awareness. In your opinion, how have decision rights been affected by BFT?

	Shifted to Junior Leaders		No Change		Shifted to Senior Leaders
Decision Rights	○	○	○	○	○

Additional Comments

[   ]

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45. Should leaders adjust command and control architecture at the tactical level to exploit the capabilities offered by BFT (For example, flattening the organization by eliminating a layer of command), or should traditional hierarchies be kept in place?

46. Do you feel BFT allows for greater autonomy in decision making at the tactical level? Why or why not?

47. Please provide any additional comments you may have on BFT, decision rights, or command and control in general.

48. What is your current rank?

◯ O-1

◯ O-2

◯ O-3

◯ O-4

◯ O-5

◯ O-6

49. What is your primary Military Occupational Specialty (example 0302)?

50. Are you currently serving on Active Duty or in the Reserves?

◯ Active

◯ Reserve

◯ Other (please specify)

51. What is your gender?

◯ Female

◯ Male

Thank you for taking time out to complete this survey.

A.   IRB APPROVAL LETTER

Naval Postgraduate School
Institutional Review Board (IRB)

From: President, Naval Postgraduate School

APR 3 0 2010

Via: Chairman, Institutional Review Board
To: Ronald Fricker, Jr., Operations Research Department
       Maj. Mathew Dreier, USMC

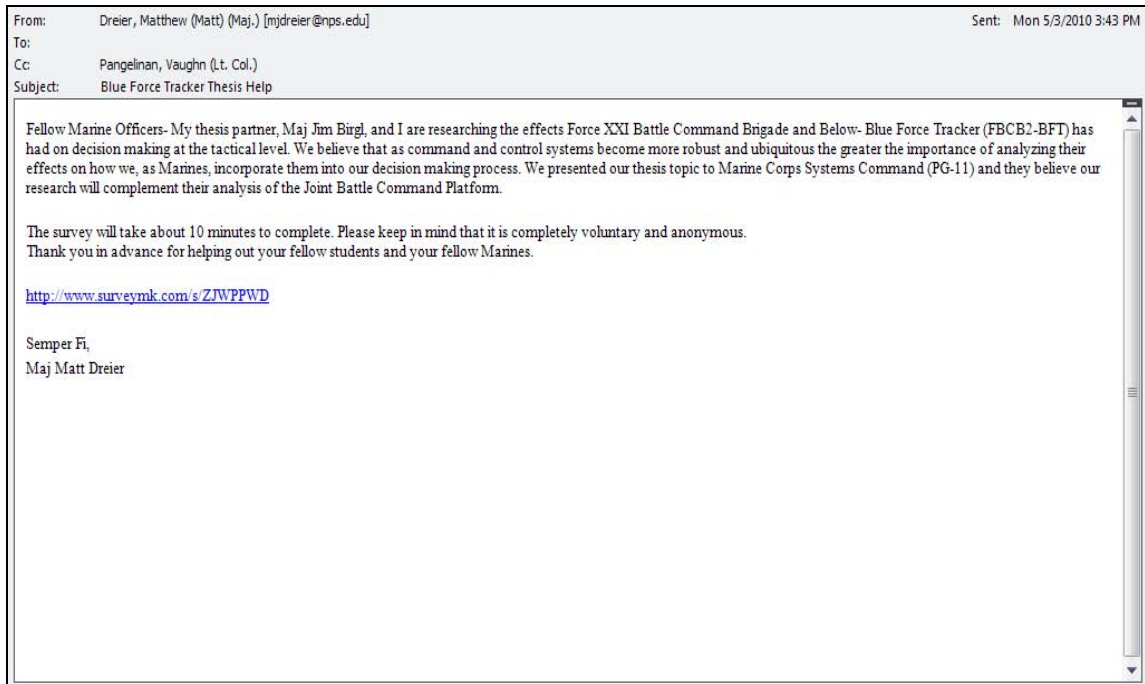SUBJ: FORCE XXI BATTLE COMAND BRIGADE AND BELOW SURVEY

Encl: (1) Approved IRB Protocol

1. The NPS IRB is pleased to inform you that the NPS President has approved your project (NPS IRB# NPS.2010.0066-IR-EP7-A). The approved IRB Protocol is found in enclosure (1). Completion of the CITI Research Ethics Training has been confirmed.

2. This approval expires on 31 October 10. If additional time is required to complete the research, a continuing review report must be approved by the IRB and NPS President prior to the expiration of approval. At expiration all research (subject recruitment, data collection, analysis of data containing PII) must cease.

3. You are required to report to the IRB any unanticipated problems or serious adverse events to the NPS IRB within 24 hours of the occurrence.

4. Any proposed changes in IRB approved research must be reviewed and approved by the NPS IRB and NPS President prior to implementation except where necessary to eliminate apparent immediate hazards to research participants and subjects.

5. As the Principal Investigator it is your responsibility to ensure that the research and the actions of all project personnel involved in conducting this study will conform with the IRB approved protocol and IRB requirements/policies.

6. After the experiment is completed the Principal Investigator will submit to the Human Subjects Protection Office, all signed informed consent documents, unanticipated problem reports, adverse event reports and a End of Experiment Report. The Human Subjects Research Office will secure these documents for 10 years and then forward to the nearest FRC.

Dr. Angela O'Dea
Chair
Institutional Review Board

Daniel T. Oliver
President
Naval Postgraduate School

B.   E-MAIL SOLICITATION

From:	Dreier, Matthew (Matt) (Maj.) [mjdreier@nps.edu]		Sent:	Mon 5/3/2010 3:43 PM
To:				
Cc:	Pangelinan, Vaughn (Lt. Col.)			
Subject:	Blue Force Tracker Thesis Help			

Fellow Marine Officers- My thesis partner, Maj Jim Birgl, and I are researching the effects Force XXI Battle Command Brigade and Below- Blue Force Tracker (FBCB2-BFT) has had on decision making at the tactical level. We believe that as command and control systems become more robust and ubiquitous the greater the importance of analyzing their effects on how we, as Marines, incorporate them into our decision making process. We presented our thesis topic to Marine Corps Systems Command (PG-11) and they believe our research will complement their analysis of the Joint Battle Command Platform.

The survey will take about 10 minutes to complete. Please keep in mind that it is completely voluntary and anonymous.
Thank you in advance for helping out your fellow students and your fellow Marines.

http://www.surveymk.com/s/ZJWPPWD

Semper Fi,
Maj Matt Dreier

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